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THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

Change of Meeting Place, Western Gas Association.

OFFICE OF THE SECRETARY, WESTERN GAS ASSOCIATION,
NEW ALBANY, IND., Feb. 7, 1898.

To the Members of the Western Gas Association: The Board of Directors of the Western Gas Association, acting in accordance with Section I., Article VI., of the by-laws, have voted to change the place of our next annual meeting (May, 18–20) from Mount Clemens, Mich., to Detroit, Mich.

They did so upon the recommendation of the Executive Committee, who last month visited Mount Clemens. They found the hotel arrangements inadequate to accommodate the numbers of members likely to be present, unless they were divided amongst three separate hotels. No definite assurance that a suitable room could be obtained to hold our meetings, together with the fact that the means of transportation to Mount Clemens from Detroit—at which latter place the majority of the delegates to the meeting would first arrive—might occasion vexatious delays, caused the Executive Committee to unanimously submit to the Board of Directors the proposition to change the place of meeting to Detroit, with the above stated result. JAS. W. DUNBAR, Secretary.

[OFFICIAL NOTICE.]

Twenty-eighth Annual Meeting, New England Association of Gas Engineers.

OFFICE OF THE SECRETARY, LYNN, MASS., Feb. 3, 1898.

The twenty-eighth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 16 and 17, 1898.

The first session of the meeting will be called to order at 10 o'clock, Wednesday morning, February 16, for the election of new members, the address of the President, the reports of officers, the election of officers and the general business of the Association; following which will come the reading of papers and their discussion. The arguing of short topics, and other matter proposed for debate, will continue, until final adjournment, Thursday noon.

On Wednesday evening, at 6:30, the members will dine together at the hotel.

During the meeting the following papers will be read:

"Gasholder Construction," by Mr. H. A. Allyn, Cambridge, Mass.

"Desultory European Notes," by Mr. W. S. Allen, Boston, Mass.

"Some Incandescent Burners," by Mr. N.W. Gifford, New Bedford, Mass.

"The Winning Ways of Gas," by Mr. William McGregor, Pawtucket, R. I.

It is thought other papers will be read, and it is also expected that several "short topics for discussion," the subjects of which will, if possible, be announced before the meeting, will be presented.

Blank applications for membership can be obtained from the Secretary. Applications for membership, and all other matters for the consideration of the Directors, should be forwarded to the Secretary before Tuesday, February 15. CHAS. F. PRICHARD, Secretary.

[Official Notice.]

Fifth Annual Meeting, Michigan Gas Association.

Office of the Secretary,
Saginaw, E. S., Mich., Jan. 11, 1898.

To the Members of the Michigan Gas Association: Gentlemen—You are hereby reminded that the fifth annual meeting of our Association will be held on Wednesday, the 16th, and Thursday, the 17th, days of February next, at Port Huron, Mich.

The new Hotel Harrington has been selected as Association headquarters, with rates, for all rooms without bath, at $2.50 per day; with bath, at $3 per day. From experience at our recent meetings it would be well to have rooms reserved as early as possible.

The following papers will be presented for consideration:

"Experiments with the Welsbach Lamp," by Mr. Frank H. Hess.
"An Automatic Closed Purifier," by Mr. Henry G. Beatley.
"Our Patrons: How to Treat Them," by Mr. S. Milo Dole.
"The Utilization of Coal Tar by Distillation," by Mr. Edward J. Ellis.
"Reminiscences," by Mr. Robert Calhoun.

Mr. Fred. J. Howden will also present a paper, the title of which is not received. Respectfully yours, Henry H. Hyde, Secretary.

BRIEFLY TOLD.

The Meeting of the New England Association.—If prediction based on prior signs goes for value, the meeting this week of the New England Association will be an enjoyable reunion, in that those who will take part in it have the sustaining knowledge that their trade in the East has gone ahead, without symptoms of passing beyond. Nor should this introduction be interpreted for other than is meant, since the facts are that the industry in New England has gained pronouncedly in volume between the times of the Association's 27th and 28th convenings. The growth, too, is healthy, if one excepts the difficulties connected with gas operations in Boston—suburban and otherwise—and even there the growth is healthy, from an engineering point of view; no matter what entanglements are in sight as a result of certain Rogerian-Addicks operations. The Rogerian mention recalls the unfortunate fact that the meeting of the New England Association will be marred by an accident that resulted in bodily harm to Mr. N. W. Gifford, of New Bedford. Mr. Gifford, who is the responsible works' man of the New Bedford Gas and Edison Light Company, during and after the severe storm which scored the central and north New England coast on the 1st inst., while overlooking the standing of a relief holder, received physical injuries sufficient to keep him from the meeting. He was on the regular list for a paper on "Some Incandescent Burners," and although it is likely the paper will be read, its author will not be able to voice it in person. Outside of this unfortunate occurrence, and apart from the sad knowledge that death claimed two of the membership—oddly representing the young and old, in the persons of Fred. W. Norton and George D. Cabot—the meeting promises to be equal to sustaining and maintaining the reputation of the Association from any standpoint whatever.

The Meeting of the Michigan Gas Association.—Secretary Hyde, of the Michigan Gas Association, and the other executives of that Wolverine gas body, are to be congratulated over the interest that their joint efforts have aroused in the annual sessions of the Association. The paper list is long, its numbers are promising, and our knowledge that the attendance will be representative is positive. Of course, it is regrettable that the Michigan men did not see their way clear last year to putting their meeting time over to dates that would not conflict with those of the New England Association; but if they think that Michigan, in March, is preferable to Michigan, in April, why they know best. Perhaps the subject of the Hall process of gas manufacture, as exemplified in Kalamazoo, will be discussed at the meeting; and we hope it will be so discussed, for many in this vicinity hold the idea that, by the aid of Hall gas, from its peculiar heating value, celery may be kept crisp, but free from the blight of too low temperature.

Notes.—The petition of H. M. Whitney, President of the Massachusetts Pipe Line Gas Company, that the Board of Gas and Electric Light Commissioners approve an issue of $1,000,000 stock by that Company, was to have been argued last week. Subsequently, Mr. L. S. Dabney, for the Company, withdrew the petition, and more will be heard about it later.——At the annual meeting of the shareholders in the Washington (D. C.) Gas Light Company the following Directors were elected: J. R. McLean, J. W. Orme, G. T. Dunlop, J. C. Bullitt and J. F. Rodgers.——Gas is now being regularly supplied by the Newport News (Va.) Gas Company. The initiation went off without a hitch.

Is Dustbin Refuse a Fuel?

[By Mr. Norton H. Humphrys, F.C.S., in *Journal of Gas Lighting*.]

The references that have been made in these columns to the success of the municipal destructors erected at Shoreditch as a medium for raising steam to be applied to the generation of electricity and other purposes, come as a surprise to many who have good reasons for believing that dustbin refuse is not a fuel; and therefore that, so far from being a source of heat, it does not contain sufficient potential energy to ensure its own destruction, but requires additional fuel from some outside source for that purpose. This is not merely a matter of opinion. The modern cry of "Every householder's electric light from his own dustbin," is only a new setting of an old tune. Long before the possibilities of electricity took the public fancy, and became a cheap and safe topic for anyone who wishes to pose as a platform scientist, the idea was propounded that the household dustbin contained among its treasures a sufficient quantity of carbonaceous matter to furnish, with or without the aid of the grease and suds that are usually disposed of through the medium of the scullery sink, a sufficient supply of gas for any reasonable amount of artificial lighting. But practical investigation soon laid bare the fact that ordinary household refuse was loaded with moisture and incombustible matter to such an extent that, even when provided for nothing, it was more costly as a gas-making material than ordinary coal at current prices. It resembled in this respect certain varieties of peat, which in their natural state are so loaded with earth and moisture as to be useless for fuel purposes. But the peat can be air-dried by simply cutting in sods and storing under cover—a process which is obviously impracticable in the case of house refuse.

In many localities, there are waste tracts of land, upon which household rubbish is deposited in large quantities; and a favorite amusement with street urchins is to rummage about and gather up scraps of paper for a surreptitious bonfire. The fire, however, never spreads. If the mass was inflammable, the ready means of disposing of it that are thus suggested, would have been put into practice long ago. Instead of paying a contractor 50 or 75 cents per load to get rid of the stuff, it would simply be taken to the nearest patch of common or waste land, and there destroyed by fire. Further, there is a demand for fuel in every household. If the refuse is inflammable, there is a destructor at hand, in the form of the kitchener, the scullery stove, or the copper firehole, where all waste matter could be got rid of at once, instead of being stored on the premises for a week or so before being fetched away. There is not only the cost of collection and removal, but frequently this also means conveyance through, or round to the front of, the house.

The process, particularly in warm weather, is anything but satisfactory, and would be gladly avoided if there was any possibility of doing so by burning it on the premises. And when the modest 5th of November carnival is held in the back garden, and every scrap of paper, old boxes, or other inflammable matter is hunted up, why are the contents of the dustbin left untouched? Simply because they are not inflammable, and that being so, where does their value as a fuel, for raising steam, or for anything else, come in? Anthracite and other kinds of fuel that are useless for household purposes can certainly be consumed under forced draught and other ingenious devices; but no amount of mechanical ability can convert a substance that is not inflammable into a useful fuel.

There is no reason for surprise at the fact that the contents of the Shoreditch dustbins should be brought in as an item in the calculations of those who talk and write about cheap electricity. The science of electricity has been advanced to a state of great precision. An important feature is the extreme delicacy of many of the instruments used. One would suppose that the facility for mathematical calculation in respect to almost every point in connection with the generation or distribution of electricity that is thus rendered possible, would tend by the natural sequence of things to produce a steady-going, hard-headed individual, who proved everything by experiment and deduction, and was free from the weakness of an erratic imagination or fervid flights of fancy. Yet it seems to have a contrary effect; for there is, among those who ought to know better, more wild talk about the possibilities of electricity than on any other known topic. Edison's invention was the indirect cause of a great deal of oratorical extravagance, in which the utter displacement of gas was only one item. Lately there are signs of a repetition of this craze—the old dislike of gas being still retained; and the modern form of the delusion is that, light for light, electricity is much cheaper than gas. Electricians go into a town, and if there is a stream of water large enough to turn a wheel in the vicinity, a great point is at once made of "the natural advantages;"

and the public are led to hope for cheap electricity as a consequence. Yet the London Electric Lighting Companies, with their works on the banks of a large tidal river, prefer to trust to coal and steam.

It has also been stated that the cost of utilizing the natural advantages of Niagara as a source of power, is greater per horse power than that of providing steam for the cotton mills of Lancashire. But if practical operations are commenced, the first item is an engine and boiler house. When it comes to the question of the practical value of the lights, the small end of their mental telescope is invariably directed towards electricity, while the large one is used for gas. They appear to believe that an 8-candle power electric lamp is equal in practical effect to an ordinary flat-flame gas burner, though three or four times as many such lamps are required to get the same lighting effect. I have seen a shop that was formerly lighted by six Welsbach burners, illuminated by twenty such lamps, and do not think that any independent observer could pronounce the light to be improved.

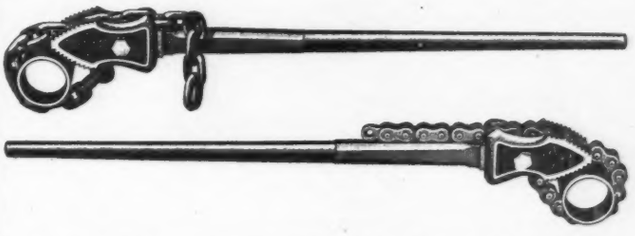
Another common delusion is that a rusty and badly gone iron union jet is a fair sample of the lighting appliances at present available for the use of gas consumers. There is reason to be thankful that there are no residuals in the generation of electricity. If there was anything corresponding to coke, tar and ammonia, the public would be regaled with rhapsodies on the subject of cheap fuel, valuable chemicals and home manures. We are used to the vagaries of electricians by this time, and no harm would be done if the attention of ignorant or ultra-nervous people was not occasionally caught, rendering them quite unable to rest until they have disposed of their gas shares, usually at a price much below the real value of the property. This category includes ladies and elderly persons who are least in a position to lose money; and therefore almost a criminal responsibility attaches to reckless statements that may have a prejudicial effect on any class of investments. The higher the position of the speader, the greater the necessity for caution. Having all this in view, one need not wonder at the notion of generating electricity from stuff that will not burn. We may next expect to see the old Latin motto altered to: *Ex nihilo*—comes electricity.

But what is the explanation of the known fact that steam is raised at Shoreditch, and that the dustbin refuse is destroyed? Simply that some extraneous source of fuel is available, a portion of which goes to drive out the moisture and heat up the house refuse to a temperature at which the combustible part is consumed, and the remainder to heat the water in the boiler. The financial success, or otherwise, of any destructor system depends not on the ability to do without an extraneous supply of fuel, but on the cost at which that supply can be obtained. We are told there is a coal heap "for emergencies" at Shoreditch. At many other ptaces, the coal heap is in continual requisition; and under such circumstances, the cost of raising steam is greater than if the coal was used in the regular way. When in London a few weeks ago, I was sufficiently curious on these points to take a stroll in the neighborhood of the works at Shoreditch, and see what material was actually being taken in there. It consisted, not only of ordinary dustbin contents, but also of large quantities of trade refuse—such as sawdust, paper cuttings, etc.—and I was told that manufacturers were not only willing to deliver the stuff at the works at their own cost, but actually paid for its destruction. From this it appears the Shoreditch authorities are in the happy position of being able to secure extraneous fuel for less than nothing—which is a reasonable explanation of their success. Sometimes the supply of trade refuse—which must not be confused with household or dustbin refuse—may be sufficient to render them independent of the coal heap for several days at a time. On Sundays, or at holiday times, the supply may be short; and then coal must be used to keep up the fires. But one can readily understand that, although dustbin refuse is not a combustible in itself, if sandwiched between a load of chips, sawdust, etc., and another of paper cuttings, a different state of things obtains; and if thrown into a suitable furnace, with forced draught at the bottom, the whole may be burnt to ashes, and leave some heat available for the generation of steam in the process.

The number of industries turning out inflammable refuse that is not wanted on the premises is, however, limited; and the Shoreditch district is probably almost unique in being able to secure a supply sufficient to keep the destructors going for days at a time. There are several sawmills in my own neighborhood, for which sawdust could at one time be had for the fetching. But I am told that it is now worth $2.50 or so per ton as fuel for raising steam; and the proprietors do not care to sell it for less. I was therefore surprised to find people paying for its destruction. A destructor could not be run at a profit in Salisbury, so the public should not be left to jump to the conclusion that the Shoreditch results can be repeated anywhere and everywhere, or that it is possible for any municipal authority that chooses to make a profit out of the burning of dustbin refuse. Certainly if the destructors will work efficiently in one place, they will do so in another; but the financial aspect of the question depends very much upon the cost of the extra fuel.

The Williams Drop Forged Steel Chain Pipe Wrench.

Messrs. J. H. Williams & Co., of Brooklyn, N. Y., are putting on the market the Vulcan patent drop forged steel chain pipe wrench, a fair idea respecting which may be obtained from an examination of the illustrations. The Vulcan wrench is made with cable and with flat link chain, and is designed for gripping, turning or holding pipe, bolts, bars, shafts, etc. The wrench is made in seven sizes to take articles from ⅛ inch to 12 inches. They are made wholly from wrought steel, to be strong and durable. The drop forged jaws are stated to be of saw temper, so that the teeth can be sharpened by filing only. The pressure of the teeth, it is explained, is in a line tangent to the circumference of the pipe, which, combined with the encircling grip of the chain, prevents crushing. The wrench is sold with either cable or flat



link chain, and is the only wrench, it is claimed, adapted for either. To change the chain one cap screw is unscrewed—neither jaw is removed—the internal pin on which the chain swings is slipped out, thus releasing the chain, when the new chain may be inserted. It is remarked that the cable chains are of finest quality, only the D. B. G. special crane chain being used. This chain is hand formed and tested link by link, and bears the trademark D. B. G. It is further remarked that the flat link chains are hand made from steel prepared expressly for the company and carefully tested in an Olsen testing machine. The point is made that the chain swings from the center and can be used on either side of the jaws, reducing wear of the teeth to a minimum. The wrench, it is shown, is equally efficient on fittings and straight pipe, in corners, against walls, between floors, in ditches, or for overhead work. Each fits a range of sizes equal to six pairs of common tongs, and will, it is claimed, outwear several pairs of any kind. The tools are interchangeable in all parts, repairs can always be had, and the wrenches are fully guaranteed.

Among other advantages are that the jaws are duplicate, reversible and serrated on both sides; that the assistance of a blacksmith is not necessary when the teeth become dull; that the tool is not disabled if the teeth on one side break, as it can be instantly used on the other side; and that repairs can be secured without sending the wrench away. It is stated that the price list has been revised, while a greater discount will be offered than for any other similar tool. The makers state that the wrench is the fruit of 12 years' experience in making chain pipe wrenches, and that they claim for it superiority in every respect.

[Prepared for the JOURNAL.]

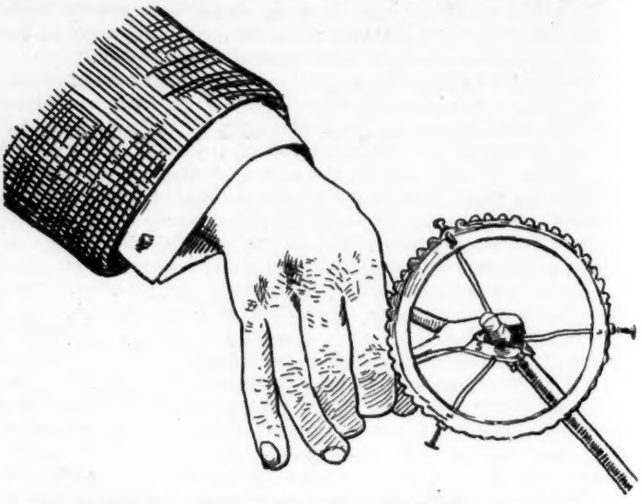
The Small Things that Make Up a Perfect Complaint Man.

By MR. GEORGE F. SUMMERS, M.E.

To quote from my street foreman, I would cut a gas man's work into "three halves;" one half in the making and two halves in the selling of the article. The most important position in the sales department is, without doubt, that of the complaint clerk, and following up his efforts are the men who straighten out the kinks at the consumer's home. Should we follow up the life of a complaint we would find it passing through three stages:

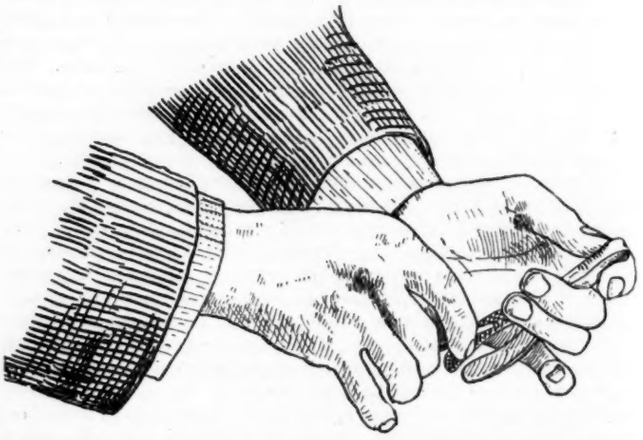
First, that something goes wrong, or the consumer thinks so, and he is generally not at all slow to impart his doubts to the first clerk he meets in the office; second, the complaint clerk, if he has a good address and a great deal of tact, will make the consumer feel of some importance by the courteous consideration shown to the complaint, and thus paving the way towards a pleasing ending to the same, which sal-

This portable tool box has been designed to facilitate expert complaint work in a minimum amount of time. The box is of tin, and, being light and clean, can be carried from room to room in a house. It contains everything necessary to meet any ordinary complaint.



One of the most frequent mechanical operations in a complaint man's duties is the adjustment of brass pillars. Strange as it may seem, there are few men that put on a pillar without damaging it. In holding a pillar, the plyers should always be put under the shade holder, close to the bottom of the pillar.

The contents of the box include among other things a bottle of white lead, with a stick to apply the same; a gasoline torch for testing joints without smoking the part; a pair of smoked glasses for examining mantles; a reamer for Welsbach lights and stoves; a wire for cleaning stoves; a box of meter washers; and tips, packed nine in a box, ready to be left with the consumer for future use.



There are few things that do the gas company's reputation more harm than the indiscriminate striking of matches on the furnature and walls. The match should be struck on the handle of the plyers, and the sticks put in the cover of the open tin box, and emptied in the kitchen upon leaving the house.

vation is worked out by the man with the Stillson wrench; third, if the affair has been handled properly the consumer is led to believe that the gas company folks are real nice people and it is a pleasure to deal with them. He is impressed with the business ability and sterling honesty of the company, both as a corporation and as individuals, and the next time his bill is large he is satisfied that it is correct and that he has used the gas, and he tells his neighbors so.

A complaint once came in to the works with which I am connected, of "big bill, remove and test meter;" and as I happened to see it, went out myself. I found the woman cleaning a kerosene lamp. There was sickness in the house, the kitchen table was covered with dirty dishes, the complicated lamp burner would not work, and the woman looked dismayed. I took off my cuffs, cleaned and adjusted the lamp burner and admired the lamp itself, all the while exclaiming that we would rather have her burn less gas if she could not afford to pay as much for light as she had that month. She seemed surprised that I should talk reasonably about her lamps, and I went back to the office to find that her husband had gone to business "mad" that morning and had written me a very disagreeable letter. However, when he got home that night, and heard his wife's report of "the young man that came to fix the gas," he wrote me a second letter, and a very polite one it was, saying that, after all, perhaps he had used the gas, and if the meter had not already been changed, never to mind about it. Those people are good friends of ours now, burn as much gas as ever, and next summer I am going to sell them a gas range.

A live superintendent will keep better posted than anyone else in town, and watch day and night to take advantage of every move to increase his consumption. In my judgment there is no better way to do this than for the superintendent to take up an occasional complaint personally, and while putting in new tips or rereading a meter, incidentally inspect all previous work, get better acquainted with the consumer and speak a good word for the line of goods he is trying to push at the time. This is the way that big outputs are worked up.

The Present Efficiency of Incandescent Lamps.

[A paper read by Mr. John E. Randall, before the Northwestern Electrical Association.]

The present efficiency of incandescent lamps for central stations lies somewhere between 3 watts and 3½ watts per candle power. It might appear from these limits that no advance has been made in the lamp industry during the last thirteen or more years of its extensive growth. As long ago as 1885 we heard of 2½-watt lamps, and 3½-watt lamps were considered a regular article of commerce. At the Detroit meeting of the National Electric Light Association in 1887 a 1½-watt lamp was described. As no one in the business is advocating longer lives than was claimed ten years ago, it would appear from the figures named above as if the manufacture of incandescent lamps had retrograded and was approaching the state of a lost art.

If the falsity of this supposition were not demonstrated every night one might be pardoned for thinking the industry was disintegrating.

Every investigation of claims for extremely high efficiency has shown that there was some hocus-pocus; either the candle was of the wax taper variety, or the watt was not one of the family that James made famous, or else the lamps didn't live to tell the tale.

Finally, people forgot about the 1-watt and the 2-watt lamps, and concluded to take what they could get, which might be anything from 3 to 5 watts, depending upon what the maker had ready to send. It really was a matter of small moment whether the lamps were 3 or 5 watts per candle, since they all went to 5 watts the next day after they were placed in circuit.

This state of affairs has continued, with some improvement, until a comparatively recent date. In the meantime elaborate series of life tests were made under the auspices of the Franklin Institute; Mr. W. H. Pierce made an extended test; several foreign tests appeared, and tests were made at the Ohio State University of samples from thirteen different makers. There was nothing promising in the general results of all these tests, and for a time the outlook was rather gloomy. Progress was being made, however, although the results were not published. It was found that lamps whose initial efficiency was less than 3 watts per candle power would not last a reasonable time on commercial circuits. This set the maximum limit of efficiency. The minimum was set by what the people would accept, and it was placed at 4 watts. More recently all energies have been exerted to produce types suitable for the various kinds of uses. We have now the highly efficient central station lamp, the isolated plant lamp and the railway type, besides numberless modifications for special uses.

Among the lamps in the Franklin Institute tests was one Weston tamadine 16-candle power lamp that maintained its brilliancy and gave most excellent life. It was the only one of the type, and almost the only one in the test that gave any indication of good quality, as quality is gauged at present. So far as that test went the tamadine lamps were a commercial failure, yet this one lamp showed what might be gotten from a cellulose filament. Since then the cellulose filament has been brought to a degree of perfection far surpassing its prototype. While made by a process differing from Mr. Weston's, the present filaments possess all the good features to be found in this early lamp and have outgrown most of the poor ones. Upon the quality of this cellulose filament I base a claim that the present efficiency of incandescent lamps is better than it ever has been, and is so much better that the lighting industry is to be congratulated.

The incandescent lamp is still a filament of carbon of high resistance hermetically sealed into an exhausted glass globe, with conducting wires passing through the glass. Its quality as an illuminant depends directly upon the quality of the filament and the quality of the vacuum. The object of the vacuum is threefold:

1. To reduce the energy expended per unit of light emitted, because of the heat lost through convection.
2. To prevent injury to and destruction of the carbon by burning.
3. To prevent injury by abrasion or so called "air washing."

Any gaseous envelope will carry away the heat energy from an incandescing body so rapidly that a great amount of power must be supplied to maintain its surface at a temperature corresponding to a certain brilliancy, the core being at a far higher temperature. This loss becomes less as the pressure of the surrounding gas is decreased, until a point is reached beyond which no further changes can be detected. When the vacuum reaches 1 part in 1,000 the loss becomes extremely small, and, after a vacuum of 1 part in 10,000 is reached, the loss is negligible so far as our present methods of measuring light can determine.

Some years ago we made a series of measurements showing the relation between the degree of vacuum and the power necessary to produce a definite candle power from a lamp filament. The net results showed that, so far as the convection losses are concerned, the degree of exhaustion ordinarily found in incandescent lamps is better than need be.

Carbon at high temperature cannot resist the attacks of oxygen. Therefore all oxygen must be eliminated, even slight traces causing injury to the carbon surface.

We would naturally suppose that the residual gas was composed of oxygen and nitrogen, in the proportions found in air. The induction coil shows that such is not the case, and I believe that in a properly exhausted lamp, although no other gas may be purposely admitted to displace it, no oxygen remains. It is known that a filament will rapidly decline in brilliancy if the vacuum is low, because the radiating surface is injured, but it will not burn out. Very few lamps burn out because of poor vacuum, unless cracked, when, of course, fresh oxygen is constantly admitted.

While the effects of abrasion formerly were considered of importance, my experience indicates that at present at least they are of small consequence. A high degree of exhaustion, as measured by a vacuum gauge, is not the object to be attained; an unchanging vacuum is essential to the maintenance of the highest brilliancy. In the type of lamp made five years ago a positive injury resulted if the vacuum were made too high. The disintegration of the filament, due to evaporation of carbon, not only injured its surface, but seriously darkened the bulb.

The vacuum does not grow poorer with age, provided the lamp is properly made and exhausted in the first place. The vacuum changes as the lamp is burned, and a part of the lamp maker's art is to reduce these changes to the smallest degree. But the vacuum is finally higher than at the start. Nothing is tighter than the glass and wire joints of a properly made incandescent lamp. Absolutely no leak can be detected after years. In some lamps used for at least 12 years in rheostats where the current at times brought them to full brilliancy, the vacuum was as good as when first made.

Many think that all lamps gradually lose their vacuum. This mistaken notion was caused, no doubt, by a fault common to many individual lamps having the old form of seal at the base, and illustrates the influence which apparently unimportant details exert upon quality as well as the necessity for wide information and extended experience in successfully making lamps.

The present lamps, made by modern methods, have perfect joints, or else the leaks are so bad as to instantly discovered by proper inspection.

The filament is the most important element of the lamp, so far as efficiency is concerned. Filaments are now made from a form of cellulose, reduced chemically to an amorphous state.

Not many years ago, when the bamboo carbon was supreme, we had occasion to complain about the poor quality of a certain lot of bamboo strips which we had received from an importing firm. They said that they could not guarantee a natural product. This furnished the key to the success of the cellulose filament. Art replaces nature, breaking down the structures of a fiber, reducing it to a plastic condition, then spinning a thread radically different in appearance and character from the original material. Instead of whittling down a stock to make a lamp filament, we now cause the filament to grow.

The quality of the filament is determined by the thread. The process of squirting threads is controllable if proper skill, experience and appliances are employed. Yet the weather is more controllable than is the quality of the product when any of these requisites is lacking. It is easier to shave down strips of bamboo to a uniform size, or to weave braids of silk fibers that will appear to be even than it is to squirt a cellulose thread of uniform diameter, but the bamboo strips and the silk braid will not be uniform in weight. They cannot, therefore, make uniform carbons.

It may be supposed that the coating of carbon applied in treating the filaments fills up the pores and depressions, thereby correcting the defects due to irregularities in texture and surface. This is not true. A poor base carbon cannot make a good lamp. When one filament is found to be better than another, its superiority can be attributed to the base carbon.

In purity, density, surface polish and uniformity, the features that determine quality and maintain efficiency, the cellulose filament, properly made, far excels any other kind.

A graphitic coating covering an amorphous carbon body in a vacuum is, so far as is known, the best combination for fulfilling these conditions. The science of lamp making consists in knowing how the carbon body can be formed, how the graphitic coating can be given and how the vacuum can be produced. The art of lamp making consists in doing these things perfectly and uniformly a thousand times over every day.

Whenever lamps are found to be uniform in voltage and efficiency they are found to be good.

In all their minor features recently made lamps are superior to those of older dates. They are uniform in shape and neater in general appearance. The caps are securely attached, and more durable in every way. They are entirely fireproof and nearly moisture proof. The bulbs are clearer, cleaner and alike in shape and size. The carbons are placed in the bulbs so as be more effective and more symmetrical. The connections, both within and without the bulbs, are more secure. Cracks and poor vacuum have about disappeared.

These features help the service that can be derived from the lamps. They form part of the general economy of operation, and therefore influence the efficiency.

Another point worthy of consideration is the evolution of types suitable for the different conditions of service; one for closely regulated

central stations, one for poorer regulation and isolated plants in general, one for street railways and other purposes in which, for certain reasons, the service is severe. Added to these are the almost innumerable varieties for special uses, such as window decorations and signs. Finally the use of cellulose has made the 220 volt lamp a commercial possibility.

It may be claimed that the new lamps are more delicate than the older bamboo, in that they cannot be run as long before the filament will break.

The principle upon which all practical methods of illumination is founded, that of incandescence—excessive activity—limits the period of effective service and induces early destruction. We may as well accept the condition of limited life, in the case of the incandescent lamp, knowing that no other light is better in this respect if all factors are considered.

I am not willing to admit that the cellulose filament is more delicate, either in transit or in service. Under identical conditions it will live longer than any other form of filament. Furthermore, the individual life approaches nearer the average than has been the case with any other material. Any carbon filament which will not obtain its bril liancy should be expected to live a good old age.

The life of cellulose lamps at 3 watts per candle power should not be compared with bamboo or silk at 4. The 4-watt cellulose railway lamps are giving more satisfactory service than those of other materials. Their light is more uniform and they last longer.

Recent lamps are approaching the ideal one which, when its work is done, breaks and thus announces its own "smashing point."

The best proofs of any claims are those based upon actual performance. In support of the claim that the present efficiency of incandescent lamps is more satisfactory than the past, I submit some comparisons.

In the subjoined table are results of tests made upon three classes of lamps: First, the 110-volt cellulose; second, the 110-volt untreated bamboo; third, the 50-volt treated bamboo. The initial watts per candle power were nearly 3.2 for all. The bamboo lamps represent their class, both the 110-volt and the 50-volt having been carefully selected. The tests upon these were a part of a series upon a large number started in groups of various initial watts per candle, and their results are consistent with those of the entire test. The tests were carefully conducted with the best facilities. They may be considered reliable. Both lamps were at one time extensively used and well regulated.

The figures shown for the cellulose lamps are the combined results of a number of tests made at various times and places and by different persons, but evidently made under similar conditions so far as regulation is concerned. There is excellent agreement, not only in averages, but in individual cases, both in candle power and in watts per candle power. The oldest tests, which were made over three years ago, show the poorest results. This fact suggests a gradual improvement in the quality of the cellulose lamp. All the lamps entering the tests were samples of commercial lamps taken at random from large lots. No claim is made that the results are remarkable. I believe that they can be relied upon to represent faithfully the present efficiency of the incandescent lamps supplied for central station use.

Average Candle Power and Watts per Candle Power of Bamboo and Cellulose Lamps During Various Lengths of Burning.

	During a Run of							
	0 Hrs.	100 Hrs.	200 Hrs.	300 Hrs.	400 Hrs.	500 Hrs.	600 Hrs.	700 Hrs.
Average C.P.—								
Cellulose volts—110...	16.	15.80	15.86	15.68	15.41	15.17	14.96	14.74
Bamboo volts—110...	16.	14.1	12.9	11.8	11.0	10.4	9.9	9.6
Bamboo volts—50....	16.	15.8	15.3	15.0	14.6	14.2	14.0	13.7
Average W. per C.P.—								
Cellulose..... volts—110...	3.16	3.26	3.13	3.37	3.53	3.51	3.54	3.74
Bamboo volts—110...	3.20	3.50	3.80	4.08	4.32	4.53	4.75	4.90
Bamboo volts—50....	3.20	3.28	3.37	3.45	3.53	3.61	3.67	3.76

The remarkable feature is the close agreement between various lots made at widely different times. This feature is the criterion of quality. Upon it depends the successful introduction and use of the highly efficient lamp. I believe that the results given can be relied upon to represent faithfully the present efficiency of the incandescent lamps supplied for central station use, because every result was used in the table, whether good, poor or indifferent.

This table shows the mean candle power during a certain period of service, and not the value found at the end of the period. For example, if a cellulose lamp, whose candle power is 16 at the start, and whose economy is 3.2 watts per candle power, is in service for 500 hours, it will average 15.17-candle power during that period, but will give less than that value at the end. If a 50-volt bamboo lamp of the same brilliancy and economy is used for the same length of time, its candle power will average 14.2. The 110-volt bamboo will, under the same conditions, average only 10.4-candle power. In the latter case, especially, the great change in the brilliancy of the lamps after they had been running for a short time would be very noticeable.

Viewed in another way, if a station furnishes a service of 50 cellulose lamps to one customer, and to his neighbor a similar number of 110-volt bamboo, charging the same for each service, the one would be justified in demanding that his lamps be removed every 100 hours, in order to keep his place as bright as his neighbor's.

A 50 volt bamboo lamp, to maintain the same average brilliancy as the 3.2 cells cellulose during any period from 500 to 700 hours' service, should have an initial efficiency of 3.4 watts per candle power. A 4-watt, 110-volt bamboo would not maintain its brilliancy as well as a 3.2-watt cellulose.

While one of the lamps involved in the tests failed before 600 hours, no other conclusion has been drawn from the facts than that the percentage of early failures of lamps, operated under good condition, is so small as to be neglected.

Lamps are to-day more uniform in wattage. A variation in current of 2 per cent., either way from the average, is rare. Candle power is tested while the lamp is revolving. Thus, the true horizontal value is determined. The value of light standards is carefully guarded and constantly checked. The accuracy of all instruments employed in the photometer room is kept at the highest degree. While an official standard of candle power does not exist, this fact has not caused the great divergence in the light value of different lamps.

The most prominent manufacturers are in agreement as to the value of the 16-candle power lamp. Their standards check more closely than do those of the technical schools. Lamps vary in candle power because of carelessness and sometimes deception in rating. In the Columbia factory accuracy of rating is considered a matter of prime importance, and constant effort is made to keep the standards exact. Each lamp has a mark whereby its history may be known. The volts at which it gives its normal revolving horizontal candle power, together with the current passing, are marked upon a suitable label. A record of these items for each lamp is made at the same time upon a sheet. These sheets are the indices of uniformity in the product.

One of the largest alternating stations in the country has, by substituting the highly efficient cellulose lamp for the low economy silk and bamboo, and by improving its regulation, been able not only to reduce the price of service to its customers but to increase its lamp capacity over 25 per cent.

There is still one condition to be fulfilled in order that incandescent lighting may be more profitable—the voltage *at the lamps* must be kept everlastingly and unceasingly steady. There has been improvement, but much more is possible and desirable. Everything about lighting service is improved where regulation is improved, even the customer's temper.

Municipal Socialism.

[A paper read by MR. FRED DELAND, before the Northwestern Electrical Association.]

The Mayor of Des Moines, a city having a population of 75,000, is the Hon. John MacVicar, who was recently elected President of the League of American Municipalities at the Columbus convention. Mr. MacVicar may yet play an important part in the political history of Iowa, for he possesses many of the attributes of the successful political leader, is a firm believer in the value of organized personal supervision in all campaign work, and ambitious to be re-elected the coming spring, not only because a second term may serve as a stepping stone to higher political honors, but because re-election would be a practical indorsement of his radical views that absolute power rests in the municipality to dictate at what rates and on what terms it may be served by corporations operating under a local franchise.

Naturally, the public service corporations do not approve of such views, and are not in sympathy with his aims and his desires. But if he deals honestly with the taxpayer and does not degenerate into the demagogue, if he patiently and thoroughly analyzes the reasons that prompt his adherents to demand that certain changes in municipal ex-

penditures be brought about, and then bases final action only on the facts as they are authoritatively recorded, his actions and his utterances may modify the plans of many an electric light, gas and street railway manager in other cities; for there is little doubt that Mr. MacVicar is ambitious to play a more important part in the coming delusion of municipal socialism than Mr. Pingree ever dreamed of.

But to succeed he must be absolutely honest with himself as well as with the taxpayer; for in every city the heart of the voting element, like the heart of a woman, resembles a lithographer's stone—political destruction alone can efface what may have been written thereon in a moment of executive action. How is it possible for a man to deal honestly with the desires of his own heart when his mind is saturated with the pernicious and fallacious doctrines promulgated by the enthusiasts of the Arena-Parsons type, who believe that large semi-public service supply corporations can easily be driven forth from a city and from a State whenever a few reformers so decide, unless the corporation submits to the whimsical demands of selfish dreamers. Mr. MacVicar may not know that one State and more than 100 different cities have tried the experiment and that their citizens now mourn the loss of nearly every dollar invested in the game. Neither may he know that the leading property owners and manufacturers in a larger city than Des Moines are now bewailing the day that they subscribed to the delusive doctrines of a man who has saddled the city with a load that a decade of prosperous years cannot remove—a load that serves as a signboard to warn away investors.

So popular is Mr. MacVicar with a certain class of municipal socialists that his friends are questioning whether he, too, will cater to that unreasoning sentiment that impels the unthinking to blindly follow these self-elected reformers who rail at existing conditions and demand a change for partisan reasons only. Or does he already realize how capricious is the changing fancies of superficial and selfish reformers, and how unstable such support has usually proven to the politically ambitious? Enthusiastic as the advocates of municipal ownership may be in promoting the aims of an ambitious leader, let the thought once be impressed on their minds that the logical outcome of municipal socialism as practiced thus far has been personal inconvenience or personal financial loss to nearly every property holder or manufacturer in the city, either in direct taxation, or in lessened values, or in loss of profitable trade, and all enthusiasm will vanish.

Some of Mr. MacVicar's warmest friends already perceive how injuriously the city's commercial growth may be affected if word goes forth to capitalists that industrial corporations supplying semi-public service in Des Moines are not considered entitled to the legitimate returns that the public is always willing to grant investments in hazardous enterprises, even such returns as are properly referred to as "the manufacturer's profit." And these friends perceive how detrimental may be the reaction in sentiment when capitalists comprehend the true inwardness of the Mayor's recent action in issuing an edict that the sum of $6.25 per month or $75 per year only shall hereafter be paid for each arc light of 2,000 candle power burning all night and every night in illuminating the streets of Des Moines, and that ¼ of a cent. per hour shall be paid for each 16-candle power lamp supplied for the use of city.

For these friends know that the Mayor was well aware that the average cost of producing an arc light in the largest and best municipal plants in the country was $85, not taking into question the matter of legitimate profits that naturally belong to a private corporation, or even certain local charges that a commercial company must always pay. Yet he deliberately set his seal of approval on an edict that virtually informs capitalists that rather than pay a reasonable profit to industrial corporations the citizens of Des Moines prefer either to deal unjustly where the capital is so invested that the company has no alternative but to accept the unreasonable offer, or else the citizens will lock up more than $100,000 in an experimental enterprise—that will prove an effectual barrier to the healthy growth of individual enterprises of like character.

The facts in the premises are as follows: For several years the city of Des Moines had paid the sum of $126 yearly for each arc lamp of 2,000-candle power used in street illumination. Soon after his election Mr. MacVicar started a movement to secure a more favorable contract for the city, and to strengthen his claim for a reduction in rates, secured from various sources official data regarding prices paid by other cities for street illumination, and what the actual cost is where municipalities own and operate the lighting plant.

As there are three local lighting plants in Des Moines, several conferences were then held with a view to the city purchasing one of the three; but a prohibitory price having been placed on the property, negotiations ended and the Mayor began to look elsewhere. Then the engineering firm of McCaskey & Holcomb made a proposition to build, within six months from date the contract was signed, an acceptable modern lighting plant for a sum representing about two-thirds the actual cash investment in a local plant of similar capacity, as follows:

To build a lighting plant complete for supplying 500 arc lamps of 2,000-candle power and 1,000 incandescent lamps of 16-candle power, for the sum of $105,385; the city to furnish a suitable lot on which to erect the station; payment to be made as follows: $60,385 on completion of the plant; $25,000 one year after completion, and $20,000 two years after completion, the eng.neering company to retain full possession of the plant until the final payment is made, and also to receive from the city the annual sum of $32,500, in equal monthly installments, for the period of two years, to compensate the engineering company for supplying 500 arc lights for all night and every night street illumination; this being an average cost to the city per arc light of $65. The city also to carry during those two years not less than $20,000 of fire insurance on the station, and not less than $50,000 of tornado insurance on the entire plant.

The question of municipal ownership being submitted to the voters at a special election, it was carried by a majority of 2,416 in a total vote of 5,176, and the proposition above outlined was accepted and the Mayor authorized to sign and deliver the contract. At the previous regular election the total number of votes cast was 13,000, showing that less than one-half the usual number of voters felt sufficiently interested to cast a vote.

As the Mayor was signing the contract a taxpayer endeavored to prevent this action, but being defeated he then petitioned the courts for an injunction restraining the city from carrying out its contract. On January 17 Judge Bishop held the contract "to be invalid, because it is different from that called for in the specification and the published call for proposals."

But when the contract for lighting the streets at the old rate of $126 expired, the Mayor issued an edict based on the authority conferred in an ancient ordinance, that henceforth the city of Des Moines would only pay $75 per year for each arc lamp of 2,000-candle power used all night and every night for street illumination.

Admitting that $75 is a higher rate than the $65 which the engineering firm offers to supply the lights for, let us endeavor to ascertain whether the Mayor was justified by the official records at his command in so arbitrarily fixing on $75 as a rate which the local lighting companies must accept.

The proposed cost of arc lighting in Des Moines, when the municipal plant is in operation, will be:

Contractor's charge, per arc lamp	$65.00
Insurance on plant, per arc lamp	1.00
Sinking fund or depreciation, at 5 per cent. per arc lamp	10.00
Total cost	$76.00

The last official report of the cost of street lighting in Detroit shows that the annual cost to the city of Detroit for each arc light of 2,000-candle power, burning all night and every night, was $89.42, while operating 1,600 arc lights out of a possible 2,000, the remaining 400 being held in reserve. This cost of $89.42 was the total of five items: Labor, $43.57; material, $20.62; depreciation, $1.85; interest, $18.28; taxes, $5.10. Depreciation is largely accounted for by maintaining the entire equipment in the best possible condition. But where complete replacement must ultimately follow, a depreciation charge of only 4 per cent. on first cost is entered. The total investment in Detroit is $714,843.76; a 4 per cent. interest charge on this equals $28,593.75; the assessed valuation is $427,500, calling for a charge of $7,981.43 for taxes.

The municipal plant in Allegheny City has been in service for several years and operates 1,100 arc lights of 2,000-candle power, and nearly 9,000 16-candle power incandescent lamps. The cost per arc lamp per year is $74.32, divided as follows: Operating expenses, $53.55; interest charges at 4 per cent., $10.73; depreciation charges at 3 per cent., $8.04; taxes lost by city, $2. The cost of the arc plant was $259,258.43; of the arc and incandescent plants, $348,921, the city supplying the land. Included in the operating expenses per lamp per year were: Lamp trimming, $8; inspectors, $2; insurance, $1; coal, at $1 per ton, $10; supplies, $4.20; repairs to arc equipment, $5.50; office and miscellaneous, 30 cents; repairs outside, $5; labor at station, $7.50; salaries at office, $3.25; carbons, $5; total, $51.75.

Mr. Hunter, the gentleman in charge of the Allegheny plant, has publicly stated that, in his opinion, a fair price for commercial companies having overhead construction to charge for street lighting where arc lamps of 2,000-candle power were in service for 4,000 hours, is $80 per year, where good coal costs $1 per ton; if coal costs $2 per ton, $90;

and $100 if coal costs $3 per ton. If the circuits in the downtown district are underground, an increased ratio should be allowed to cover the interest on the increased investment necessary.

The facts regarding the Topeka municipal plant were officially reported in 1896, as follows: "The plant consists of a lot and building by a railroad switch; three boilers and three engines (worked to 235 horse power); six 30-light Jenney Indianapolis arc dynamos; six circuits with $24\frac{72}{100}$ miles of line, and $33\frac{8}{10}$ miles of wire, supported on 943 30-foot poles; and 184 lamps of 2,000-candle power each, placed 1,100 feet apart one way and 800 feet the other; a test of 17 lamps showed an average pressure of $23\frac{17}{100}$ volts, and a current of 19 amperes equals $439\frac{55}{100}$ watts, or 1,953 nominal candle power. The lot and building cost $8,559.33; the plant, poles and wire, $46,888.65; total cost, $55,447.98."

In May, 1896, after less than seven years' service, the old machinery in the Topeka plant was condemned as wasteful, unsuitable and unserviceable, and was finally exchanged for modern apparatus at an additional cost of $13,772. And in making this exchange only $1,500 in trade was allowed for the old apparatus, which means a depreciation exceeding 10 per cent. per year.

The officially reported total "cost of operating the Topeka electric light plant," from November, 1889, to December, 1892, inclusive, was $54,240.95, or and average cost per arc lamp per month for 38 months of $7.75. The operating expenses are thus itemized, it being stated that "the best lump coal has been used, at an average cost of $2.75 per ton." Coal, $13,924.64; carbons, $2,981.31; globes, $235.80; oil and waste, $642.70; repairs, $4,847.57; insurance, telephone, etc., $1,329.96; payroll, $19,743.85; interest, at 6 per cent., $10,535.12. The total cost to May 31, 1896, is $85,700.

In other words, Topeka paid during the first six years of municipal ownership, when machinery, circuits and lamps were new and in good condition, and cost of maintenance low, $93 per year for each arc light used in street lighting, not taking into consideration the extra investment necessary to replace old machinery, or the risk that attends all enterprises of like character, plus the loss of water rates, taxes, etc., which a private corporation would have paid. Moreover there is $70,000 of the taxpayers' money locked up forever.

To recapitulate: The cost per lamp per year in the three most promising plants cited is shown to be officially reported as follows:

Detroit, Mich.	$89.42
Topeka, Kas. (moonlight schedule)	93.00
Allegheny City, Pa.	74.32

Or an average cost of $85 per year per arc lamp. These are figures that every practical and honest engineer would accept as showing the best that has been accomplished under the most favorable local conditions. For the economical administration of the municipal plant in Allegheny has always been worthy of commendation, even by engineers who could not approve of the low allowance for depreciation. And the commission of six citizens under whose wise administration the Detroit municipal plant was placed in operation, and who gave two years' services free of compensation in any form, was guided in all its deliberations by a chairman whose wide experience and practical ability in successfully solving vexed problems arising in large financial undertakings has been amply demonstrated in many ways. And this commission secured the services of a practical electrical engineer of established integrity who had designed, built and operated many electric lighting plants under conditions differing in each case.

In view of these facts from official reports, and of Mr. Hunter's statement that where good steaming coal costs $1 per ton, $80 is a fair price for commercial companies to charge for street lights of 2,000-candle power burning all night and every night, are not thoughtful investors in corporation properties justified in wondering whether this arbitrary action of the Mayor in allowing only $75 per arc light supplied by commercial companies was simply a political stroke to gain the applause of unthinking voters? And are capitalists not justified in hesitating to invest a dollar in Des Moines? No State in the Union has a more intelligent population; few States so rich and productive as Iowa. Must all development be arrested for a term of years because a few men would sow the tares of municipal socialism in the hope that through awakening a hatred of all corporations, they may reap certain political honors?

Acetylene Explosions.

In an article on the subject named in the heading, the *Scientific American* says:

Developments have been somewhat retarded with this new illuminant, by the various accidents which have occurred at various times, and under certain conditions. It must be remembered that acetylene is an inflammable hydrocarbon gas, and possesses, by reason of its combustible properties alone, certain properties common to all gases of this series or mixtures of the same. Explosions of illuminating coal gas are common and many of our coal mine disasters are due to the explosion of mine gases; similarly vapors of benzine, dust from mills, factories or coal breakers occasionally inflame and explode under certain conditions. Therefore, the simple fact itself is not an exclusive property of acetylene, but rather that belonging to all combustible material under certain well-defined conditions.

The condition referred to is, that sufficient oxygen shall be present and intimately mixed with the gas or finely divided combustible to produce and support combustion after spontaneous or purposive ignition has taken place. Usually this oxygen is supplied by the air; and, therefore, certain definite mixtures of air with various gases are explosive, the latter term indicating that combustion takes place more or less instantly, thereby generating a considerable amount of heat, which, imparted to the gases of combustion, expand instantly and tend to increase in volume to such an extent as to burst the confining vessel or do other serious damage. Thus if we have acetylene confined in a small gasholder such as accompanies some generators, or in the generating vessel itself, it is harmless so long as it is not mixed with air, but as soon as any vent or cover is opened admitting oxygen, the mixture is liable to detonation when an open flame is brought in contact with it. And thus was caused all the explosions of non-liquefied acetylene gas which we have any knowledge of. Carbide is of such good quality that there never will be sufficient phosphorus in the gas to cause spontaneous combustion upon the admission of air to it, and should such a gas be made, it would have such an evil smell that the carbide would be rejected; for the odor of acetylene is due to the phosphureted and sulphureted hydrogen it contains. These impurities exist primarily in the lime and carbon used to make the carbide in the electric furnace.

Let us now take a brief survey of some of the principal accidents that have occurred. In France there have been a number of minor explosions. While brazing a generator which they believed perfectly free from gas, some workmen of Paris were seriously injured, as the vessel was but partially empty and contained the requisite air and gas mixture. At Fecamp a similar accident was caused by a workman soldering a gasholder without taking the trouble to empty it. A café was destroyed at Lyons by a violent explosion due to the carelessness of a boy who had neglected to close a valve on the generator, thus allowing the gas to escape into the room during the night, all ready mixed for ignition by a candle in the morning. At Milan a foolhardy inventor looked for a leak in his apparatus with a lighted candle—and found it, but was dangerously wounded in doing so. While attempting to solder a generator containing a mixture of gas and air, two workmen of Chateauroux were wounded by the resulting explosion. Again, near Toulouse, a tinsmith and his helper were endeavoring to make a generator work, and by their recklessness of consequences caused an explosion which killed both. At Compiegne, in a generator factory, while a generator was being tested, the foreman left the shop for a moment, advising his helper not to approach it with a light. He was scarcely gone before the inquisitive workman lit a candle and approached the apparatus (the bell of which had been removed), and was killed by being struck on the head by a flying fragment. At the restaurant of M. Marignac at Partet, in Haute-Garonne, the proprietor and another man attempted to clean a generator which had just been installed. He was removing the cover when an explosion occurred, injuring him seriously about the body and legs, while his friend had his right leg maimed.

Another phase of these explosions appears in an explosion at the shop of M. Caron, a bicycle manufacturer of Paris. He sold carbide to supply the acetylene lamps of wheelmen. This carbide was shipped in hermetically sealed tin cans in wood cases, having the top soldered on. While attempting to open this can in the usual way by using a hot soldering iron, he found it was not hot enough and carelessly used the flame of a plumber's lamp instead. The solder melted, but there had been enough moisture in the air inclosed with the carbide to generate some acetylene gas, and this was ignited by the flame of the plumber's lamp. A detonation followed, and M. Caron, who was sitting on the can, was burned about the upper part of his body and his workman was hurt by flying pieces of the can about the head and chest. Although this differs from the other explosions slightly, the cause is the same—applying a flame or incandescent body to a mixture of gas and air. All could have been avoided by ordinary precautions.

In Germany we find similar accidents and in England in less degree. In the United States there are a few examples of note. At Rochester,

while working about the safety valve of a galvanized iron gasholder, the experimenter was dangerously injured and a bystander narrowly escaped. It is said that the injured man was bending over the gasholder and was attempting to pull it out, evidently drawing air in at the same time and forming an explosive mixture. The room was dark and a gas jet was burning above the apparatus, the cause of an explosion thus being not difficult to trace. Similarly, at Wilmington, a boy was temporarily left in charge of a generator, and, finding the gas light growing dim, attempted to operate the apparatus. He is supposed to have opened the generator by unscrewing the cover, and to have taken a candle to examine its interior to see where the trouble was. Naturally an explosion followed. It is thus apparent that these accidents were caused by igniting an explosive mixture of acetylene and air, which mixture may contain from 3 to 50 per cent. of acetylene, the maximum effect being obtained between 12 and 20 per cent. The range with coal gas is less, beginning at about 8 per cent. of gas, and the explosive intensity is not so great.

Acetylene should not be kept under a pressure of more than about 25 pounds per square inch gauge pressure, and compressing directly in the generator has been found dangerous, as the temperature generated is liable to cause decomposition ; just as acetylene under low pressure has its one great element of danger—explosive mixtures of air and gas—so compressed or liquefied acetylene has its bete noir—temperature.

Liquefied acetylene expands remarkably under the effects of temperature, about 1 atmosphere (15.4 pounds per square inch) for a rise in temperature of about 2° F. Consequently, the heat does not have to be very great to cause the pressure in the storage flask to exceed its strength, and it bursts. The liquid at once expands into gas, and expands still further if it comes in contact with fire, or explodes with tremendous violence, if allowed to mix with air before ignition. New Haven the past year witnessed a very destructive explosion of a flask of liquefied acetylene. The evidence indicated that there was a leak in the valve of the flask caused by a fracture, and that the escaping acetylene was ignited by a match or candle used to test the regulators. The escape of gas was evidently larger than ordinary, causing a large development of flame, which heated the flask up to bursting point, and the shop was demolished by the resulting explosion. At Paris an explosion occurred in the laboratory of Prof. Pictet of a similar cylinder, due to improper handling by an employee.

About a month ago the works of the United States Liquefied Acetylene Company, of Jersey City, were demolished completely by exploding cylinders of liquefied acetylene. Although the coroner's report has not as yet been issued, the evidence seems to point to the fact that a flame was seen in the room before the explosion, apparently coming from a cylinder which had been partly filled with acetylene and blown out again to remove any air that may have been contained. This escaping gas must consequently have been ignited somehow, although the witnesses who could have told how were killed by the explosion. It must be remembered that acetylene gas is readily ignited by a spark, a lighted cigar or pipe, a red hot coal or similar incandescent body, and that carelessness or ignorance of these conditions evidently has caused many accidents. After the first cylinder exploded, the burning gas generated such a high heat that the score of other filled cylinders exploded like a pack of gigantic fire crackers. A boiler was projected through the air to a distance of 200 yards, and earth tremors were felt as far as Staten Island.

These explosions, all of which were more or less disastrous, must one and all be traced to carelessness. A careful man does not go into a cellar in which there is a leaking illuminating gas pipe, carrying a lighted candle; neither does he tumble a can of nitroglycerine off a wagon or throw a lighted cigar into a keg of powder. With the same degree of carefulness he will not approach a mixture of air and acetylene with a lighted lamp or cigar, nor will he place a flask of liquefied acetylene where any escaping gas will be ignited or the flask itself unduly heated.

A great deal of groundless fear has been induced by the above disasters. As a consequence, we still hear about acetylide of copper, although experience and experiment have not corroborated the oft-repeated warnings against it. Similarly phosphureted hydrogen has caused much disquietude, but thus far no harm has been traced to this substance. However, when the carbide is unusually impure, the gas will have a very decided fœtid garlic odor, and the products of combustion, when not permitted to escape, may cause discomfort while breathing it. American carbide is quite free from this defect, and owing to the small consumption of this gas (½ cubic foot for a 25-candle power light, as compared with 5 cubic feet of illuminating coal gas) the formation of vitiated air is slow in comparison. When breathed it is not so poisonous as coal gas. And we may safely state that, if we observe the two necessary precautions of low temperature and keeping an open flame away from the generators and gasholders, this gas is perfectly safe to use.

Therefore, generators should be located in well ventilated places, preferably out of doors, and should be opened for filling and cleaning only by daylight. Liquefied acetylene is scarcely a safe form to use this gas in, as the pressure necessary for liquefaction is at least 68 atmospheres—a pressure that in itself is dangerous and admits of no defective apparatus. Acetone as a solvent has not as yet received sufficient application to judge of its possibilities.

Electricity versus Gas for Cooking and Heating.

Assertion.—The *Gas World* reports that, at a meeting of the Northern Society of Electrical Engineers, held in Manchester, England, January 24, Mr. W. P. Adams read a paper entitled "A Survey of the Possibilities of Electric Heating and Cooking." He said the advantages claimed for electrical heating and cooking appliances, were that they were more economical in point of heat utilised than any other appliances, that they were quite without equal in point of cleanliness and general convenience, that by their use absolutely uniform results could be obtained, and that they were free from such dangers as attend the use of gas cookers, explosions being impossible and the risk of fire nil. As to electric heating, he expressed the opinion that the day was not far removed when more current would be used for that purpose than for lighting. If electricity were supplied for heating purposes, at little more than the bare cost, the suppliers would very soon find that the improved conditions under which they ran their plant would repay them handsomely. Several of the supply companies had adopted the policy of charging for power and heating purposes a price which was actually less than the total works cost, and he regarded this as an enlightened policy, in view of the fact that, assuming the plant used for lighting was employed also for heating purposes, the charge for rent, management, etc., would remain practically the same. The chief difficulties in the way of electric cooking were the rather high first cost of the apparatus and the cost of the current. A common figure for the current used for this purpose at the present time was 6 cents per unit. The ideal to be aimed at was 1 cent per unit. Although it was only possible at present for one or two companies to charge such a figure, and cover the bare cost of production, he thought that with a rapidly growing load on supply stations it would soon become general. On the question of the comparative costs of cooking by electricity and gas he said he had obtained figures from a kitchen in which both gas and electricity could be used at will. The household was a small one, consisting of about five persons, and the consumption of electricity was, approximately, 30 units per week, when cooking was done solely by this agency. When gas was employed exclusively, 1,240 cubic feet were used during a week. The cost of the electricity, at 4 cents per unit, was $1.25 per week, while the cost of the equivalent amount of gas, at 75 cents per 1,000 cubic feet, was 92 cents. Other results which had reached him indicated that the consumption of current might be reduced below the figure given, when the appliances were used intelligently and with care. For a small installation, such as that referred to, it might be assumed that a unit per head per diem would suffice for all cooking purposes. This figure would naturally be reduced in larger establishments. The best results would be obtained where there was a slow-combustion stove fitted up for the supply of hot water, as the heating of water by electricity was a most uneconomical proceeding, at any rate at present prices. For reasons such as he had indicated, he thought the supply of cooking and heating appliances should be vigorously pushed. Many of the supply companies and local authorities had no power to hire out apparatus in the same manner as the gas companies, and, in view of probable developments in this direction, he recommended that all companies and authorities applying for powers in future should include this in their applications. Existing companies, he added, could obtain the necessary powers by taking the usual legal course.

Refutation.—Commenting on Mr. Adams's paper a correspondent writes: "As a member of a firm who are manufacturers of electrical heating appliances, and naturally interested in their success, I feel sure that such statements as those of Mr. Adams can only injure and discredit an industry which fills well a certain limited place. In the infancy of the gas heating appliance trade, the same method of exaggeration was carried on, but not to a tithe of the extent. Such as it was, it discredited the whole industry, and created an army of unbelievers who

acted as a drag on it for many years. It is to be hoped that history will not repeat itself as regards electrical heating.

"I believe that one electrical unit is equal to 1,000-watt hours or 3,440 British thermal units, which latter is equal to the heating power of 5 cubic feet of coal gas. 1,620 thermal units will, in theory, raise 1 gallon of water from 50° to 212° F.; in practice, with gas, in small kettles, double this is required. Taking gas at 60 cents per 1,000 cubic feet, the cost of this is 2 cents for 6 gallons. If all the electrical energy is used and no waste occurs (a practical impossibility), at the usual 10 cents per Board of Trade unit, it will cost 31 cents to boil 6 gallons of water. It would appear that Mr. Adams ignores the water heating in the electrical arrangement, as the total current expended would not heat half the water required, to say nothing of any cooking. Allowing for one half the gas being wasted, 300 cubic feet would do the same work as the $1.25 worth of electricity (at 4 cents per unit) if none of the latter is wasted, which is impossible; and in addition to the 150 cubic feet of gas allowed for waste, another 940 cubic feet must have been thrown away if Mr. Adam's figures are correct. It would be interesting to know the retail cost of a complete electrical cooking apparatus which would do the work of the gas cooking ranges hired out by the gas companies at a few shillings per annum, say one capable of cooking a complete dinner for ten persons; also the average cost per annum for repairs and renewals, and who is to be pay for these."

Surface Plants of Bituminous Collieries.

[A paper read by Mr. W. G. Wilkins, C.E., before the Ohio Institute of Mining Engineers.]

The competition in the bituminous coal trade, like that in most all lines of manufacturing, has become so keen that only those operators whose mines are so equipped and managed as to mine, screen and load their product at a minimum cost, are able to make anything like a fair profit on the capital invested.

The writer believes that the time is not far distant when the coal operator, like the manufacturer, who does not have his plant, both underground and surface, so designed and equipped that he can effect every saving possible, will be forced out of business, or be content to supply a small and purely local trade. The writer also believes that a still further reduction in the cost of coal production will be brought about by changes which are already being effected, viz., a consolidation of various operators and corporations now operating the mines, by which such charges as commissions, office expenses, superintendence, etc., may be reduced to a minimum. On this point F. Z. Schellenberg, President of the Central Mining Institute of Western Pennsylvania, said in his annual address: "The first solution of the problem being in the consolidation of capital (and through the influence of the transportation companies it may be accomplished), for such control as may insure the regular systematic exhaustion of the coal fields, with adequate improvements for the security, welfare and health of the workman, and keeping him regularly employed to the advantage of getting the coal without waste inside and outside."

Many mines are now worked on modern principles whereby the maximum amount of coal is taken out, and have their underground workings equipped with mechanical coal cutters, mechanical haulage plants, and have economical and up to date pumping and ventilating plants, so that the coal is taken out at as small cost as possible. There is, however, still further saving by having the surface plant so designed and laid out as to screen and load the coal into the railroad cars as quickly and cheaply as practicable, consistent with the quality of coal the market demands.

It is the design of this paper to call your attention to some of the principles and appliances that should be considered in the design, laying out and construction of the surface plants of bituminous collieries, in order to save labor and expense, and therefore reduce the surface cost of the mine output.

The design and appliances of the surface plant will depend somewhat upon whether the mine be opened by a shaft, slope or drift. An ideal shaft mine would be one in which the shaft was in the middle of the tract of coal to be mined, and in which the dip of the coal was towards the bottom of the shaft, so that the drainage, as well as the load haul, would all be in that direction, which would of course mean the minimum cost for pumping and haulage. In addition, the topography at the surface around the shaft should be such that the surface plant could be so laid out as to give the smallest cost both for construction and operation. These are conditions that are quite rarely met with in practice, as the location of the railroad over which the coal is to be shipped and the topography of the surface will fix the location of the surface plant, and with these conditions the engineer must do the best he can with his underground work, making it subordinate to the surface layout.

As to the relative advantages of shaft, drift, or slope mines, the question very seldom presents itself for solution, for as said before, the location of the railroad generally fixes the location of the surface plant, and if the coal be many feet below the surface, a shaft, of necessity, must be sunk; if the coal be at about the height of the tipple floor, a drift is the result; and if the coal be only a few feet below the surface, a slope will probably be selected as the cheapest method of bringing the coal to the tipple.

The firm of which the writer is a member were the engineers of the surface plant of the Vulcan Coal Company's Treveskyn mine. The situation was such that the coal could be reached by a shallow shaft or by a slope. After consultation with the superintendent and the Company's mining engineer, Mr. Frank Greene, it was decided that the slope was preferable, not only on the grounds of first cost, but also economy in the operation. The grade in which the slope was driven was 25 feet per 100, and the grade of the main haulage way of the mine descends toward the foot of the slope at about 1 foot per 100 in favor of the loads. Instead of the wire rope haulage, usual in such cases, it was decided to use a chain haul. There are two endless chains, one in the load track and the other in the empty, the return in each being under the ties. Each chain is formed of four flat steel links, the up chain being considerably the heavier. Each chain is provided with dogs which engage a steel bar under the cars. When the loaded cars reach the knuckle at the top of the grade they are automatically released from the dogs and run by gravity to the tipple, while the empty cars are run by gravity from the kickback to the head of the empty chain where they are caught by the dogs and lowered down the slope, at the bottom of which they are automatically released, and run by gravity down to 1 per cent grade about 600 feet. The chains are driven by a 75-horse power engine situated under the tipple approach. The chains run at a speed of 60 feet per minute, and have a capacity of 4 cars a minute. So far as the haulage plant is concerned, it takes only one man to attend to it, who puts the loaded cars on at the bottom, the engine being under control of one of the men at the dump. The entire apparatus has proven very satisfactory, and it is certain that the cars are taken from the mine at a less cost than could be done with a shaft and a hoisting engine.

Having settled upon the approximate location of the plant, the first thing to be done is to have an accurate topographical survey and map made, by the aid of which the final location of the tipple, railroad tracks and buildings may be determined in such a manner that the amount of grading required and the amount of foundation may be kept at a minimum. The cost of such a survey may be more than offset by the saving that may be effected in these two items alone. In order to have a plant that is to be economically operated and built, the exact location of all the various parts should be considered in their relations to each other and be determined upon in advance of their construction. They should be so arranged and designed that if extensions or additions are to be made at any time with a view to increasing the output, it may be done with the same ideas of economy in operation in view, and in such a way as to preserve as far as possible the symmetry of the plant, and avoid the appearance of having been thrown together, as if there had been no well considered plan as to what the final plant was to be. Too many plants have been built in this way, seemingly with the idea of saving the cost of the services of a competent engineer.

Now, as to some of the economies that may be had in a well designed plant. One of the first is a proper alignment of the railroad tracks and their grades. The number and length of the tracks will depend upon the grades and amount of coal to be shipped. If only run of mine coal is to be loaded, a single track under the tipple may be all that is necessary. If lump, nut, slack and run of mine are all to be shipped, the number of tracks will be four at least, and unless the tracks are connected at both ends with the main railroad track, so that the empty cars can be dropped in at the upper end and hauled out at the lower end, there should be a track outside of the tipple tracks, so that the empty cars can be placed at the upper end without interfering with cars that are being loaded on the tipple tracks. It will be found convenient to have standing room on the tracks above the tipple, for a day's run of empty cars, and room enough to hold them below the tipple after they are loaded, especially if the mine is on a branch railroad, and dependence has to be placed upon the railroad company to do the shifting. The tracks should have sufficient down grade towards the tipple so that empty cars can be dropped by gravity by simply letting off the brakes.

The grade should, however, not be too great, as with heavy grade cars are apt to get away on slippery tracks and cause damage. Grades of about 1.25 per cent. to 1.5 per cent. are sufficient above the tipple, and from .9 to 1.2 below the tipple for the loads, especially if they are kept in good line and surface. By these precautions it will not be necessary to use pinch bars to start either the empty or loaded cars, and thus time will be saved in getting the cars to and from the tipple, and the capacity of the plant will be increased, or the time used in loading the day's run will be lessened.

A further saving of time and labor can also be effected by the use of automatic cross-over tipple dumps, such as the Mitchell, Willson, or Phillips. By the use of these no time is lost by having to pull the pit car back from the dump after its load is discharged, which is the case with the old style of dumps, before the next loaded car is brought to the dump. Their use not only saves time, but is also the means of dispensing with at least one man on the tipple. As is well known to you all the loaded cars approaching the dump release the dog holding the empty cars that have just been dumped, and allows it to pass over the dump to the kick-back, from which it runs by gravity to the return empty track. The Nelson Foundry and Machine Company has also a cross-over dump, which is tipped by means of a steam cylinder or ram, which raises and lowers the rear end of the dump.

At shaft mines the capacity of the mine may also be increased and a saving of labor effected by the use of automatic dumping cages, which allow the pit cars to be dumped without leaving the cages. At one of the mines of the Kansas and Texas Coal Company, of St. Louis, the output of the mine was limited by the number of cars that could be hoisted up the shaft. The mine being a 3-vein mine, the cars were of necessity low, and the capacity of the shaft correspondingly small.

Mr. Bond, the Chief Engineer, determined that the capacity of the mine could be increased if it could only bring more coal up the shaft. His first idea was to use the double deck cage so as to hoist two cars at the top, but after consideration gave up this idea, and instead, substituted a self-dumping hopper, suspended below the cage already used. The floor of the cage was divided in the middle and hinged at the sides, forming two doors which could be raised and fastened vertically at the sides. The coal was dumped into the hopper at the bottom, so that the mine cars never came out of the mine except for repairs. The hopper was made large enough to hold two cars of coal, so that the capacity of the shaft was thus doubled, and not only this, but the labor of three men was dispensed with at the top. With a soft, tender coal there might be an objection raised to this plan as being too hard on the coal consequent on its being dumped twice, once at the bottom and again at the top. This, however, would not be an objection at a coke works, where the more the coal is broken up the better the coke.

[To be Concluded.]

Some Notes upon Typical American Gas Works.—No. 2.

By Traveler.

The Plant of the Universal Gas Company, Chicago, Ills.—Any business that has been in existence a hundred years or so may reasonably be said to have emerged from the experimental stage. And in any such business the necessary machinery for its best conduct in such period has been well determined, with the result that one manufacturing plant is apt to be pretty much like another, except in so far as variations occur due merely to size.

As all of this undoubtedly applies to the gas industry, one finds as a result that a large modern gas works is not apt to be widely different in design from another of its same general caliber. In spite of this, however, no matter how conventional the general scheme of large plants, every one constructed reflects, in some of its details and design, points of interest, the outcome of local conditions, perhaps, or merely the individual ideas of the designer. And so in this respect we find not lacking in interest the works, of 10,000,000 feet daily capacity, completed last year by the Universal Gas Company, of Chicago, in addition to the fact that, while not the largest individual plant constructed in this country, it is the largest works erected at one time in recent years, and may, therefore, as a whole, be considered typical of current United States' gas practice.

Possibly the first thing that strikes one upon visiting it is how thickly the buildings cover the available real estate. There is no yard room to speak of. The cause of this well reflects the changed conditions of gas manufacture. Ten or twenty years ago a new works of such size would have been on coal gas lines. Long retort houses would have involved an acre or two of yard room for dumping and stacking coke, wagon room, etc. To-day it is the rare exception to find a large new coal gas works constructed. It is nearly always the more compact quick-producing water gas system which is installed, which, making no coke, needs no yard or cart room to speak of. And as real estate in Chicago is slightly too expensive to waste, the Universal buildings housing a water gas works almost touch one another—fire and passage space practically only being provided.

True to Chicago tradition the plant is located "along the river, on the south side," adding one more to the distinguished group of works already there (the Equitable, the Consumers', the Gas Light and Coke Company's south station, and that of the Peoples Gas Light and Coke Company), that have already made Chicago's gas history historic. Just what is gained, however, by nowadays locating a water gas works there, when anthracite, oil and oven coke all come by rail, is not quite clear.

Even as a sewer, the Chicago river—while seemingly already that—is yet unavailable; for it is still legally a river, and the local Board of Health continues in the delusion that gas works drainage would pollute it. Heaven save the mark! If tar and pungent cutting oil residuum would have other than a beneficial effect in killing the microbes in suspension I am much mistaken. Such drainage would certainly not add to the blackness. However, the river location was neighborly to the other companies, possibly more so than the intentions of the Universal promoters. While on location it is to be noted that a glue factory is next door. In the event of any complaint as to odors from the gas works vicinity, the gas company may have shrewdly deemed the glue works a desirable scapegoat neighbor.

As to arrangement of plant the concentration of all the so-called dirty or heavy work appears to have been the starting point. Not only the water gas generators, but the fixing benches and the steam plant as well, are all within the walls of one enormous rectangular building. The process of manufacture is on the generator retort system, so called, wherein a blue water gas, first made in plain generators, is afterwards charged with the vapors of naphtha to give it illuminating properties, the whole being then passed through benches of retorts for "fixing" into a permanent gas.

The generators are arranged in three rows of six each, across one end of the building. Of some 8 feet diameter, and in pairs, they are operated from the ground floor, the upper floor only being used for charging fuel and for barring down. While there is a fine stretch of iron floor thus above, its extent is exceedingly bad, as it confines the heat below. With the plant running full blast, in warm weather, with no adequate ventilation from the side yard doors below, the lot of the stoker operating the middle generators in the battery will be little short of a Hades, as to temperature. Only sufficient strips of flooring above to permit of charging and stoking, covering only, say, half the total area, would have been far better, as the bulk of the heat radiated below could then rise to the roof away from the workmen.

It is frequently said that "steam is cheap" in a gas works, and that most any steam plant that is safe is good enough. The designers of the Universal, however, have thought differently. With a large steam consumption in view, they evidently argued that there was no reason why the most efficient equipment, to the end of the cheapest steam possible, should not be aimed at? To that end, therefore, one finds along one wall of the house a battery of the finest quick-steaming vertical boilers—of the porcupine type, if memory serves. These are fitted with automatic grates and mechanical stokers, chute feeds and adjacent coal bins, and all other paraphernalia conducive to cheapness and ease of working. Parallel, and opposite, stand the fixing benches, of 20 feet through retorts, the "illuminators" for vaporizing the naphtha, the oil pumps, etc. Before leaving the generating house one notices the attractive, self-contained, donkey engine hoist elevator outfit used for hoisting coal to the upper floors. The clean appearance, quick action and ease of manipulation are very attractive in contrast with the slow, leaking hydraulic lifts or wire rope elevators so generally used in gas works.

From the generator house the blue or hydrogen gas passes to a small receiving holder, going through a conventional cooling and scrubbing plant en route. From this holder it is drawn back by customary exhausters and by them forced through the oil fixing benches in the generator house and then out again through the main scrubbing and condensing plant, and then on to the purifiers. The scrubbers and condensers are essentially conventional, of the grid and water tube wrought iron vertical, cylindrical form, respectively. Convenience of bye-passing and access, however, have been well provided for, the 36-inch connections being practically all kept on the floor level.

The necessary blowers, engines and other fast moving machinery

parts are grouped in one building, and are not out of the ordinary. In this building, however, may be noted an electric dynamo, reminding one that as the manufacturer of electric lamps has not at times disdained to use his competitor's gas with which to bake lamp filaments, neither has the gas man refrained from using his competitor's commodity for lighting places in his works where open flames are objectionable and a closed incandescent electric lamp is so peculiarly suitable.

The purifying house is of interest chiefly from its considerable size—it being nearly 100 by 200 feet in dimension. The 8 boxes are 36 feet square by 6 feet deep, and are arranged with valves in pairs of 2 each, and subdivided gas streams, instead of with the usual center seals and connections. Oxide, of course, is used, and a substantial set of air and steam pipes for revivifying, in situ, is arranged permanently beneath them.

Momentary surprise is felt by observing in the 10,000,000-foot works an aggregate station meter capacity of about 17,000,000 cubic feet, which further is divided into a pair of meters at one point, and three together at another. The process used explains this, however, as it will be remembered that in the generator retort systems of water gas manufacture as here used, the blue or hydrogen gas is first separately measured by itself, and is later again measured after the addition of the oil vapors. As these illuminants add about 50 per cent. to the volume of the hydrogen gas, it will be seen that the respective meter capacities would properly be in the proportion of 2 to 3, as above, and the total be 66 per cent. greater than the works' capacity.

The meters, large as they are, each one being capable of registering about 3½ million per day, are somewhat unusual in being located on the second floor level, the ground floor beneath thus affording convenient shop and storage rooms, with the least roof and building expense or waste of valuable premise room. The office of the works—true to tradition—is in the meter room, and is conveniently equipped with a private telephone system to all parts of the plant.

Outside are the usual switches, oil storage tanks, tar intercepting and drain tanks, etc. The whole air of the works betokens practicality, efficiency and sightliness. Western white brick, stone trimmings, attractive iron stairways, and a surrounding stone wall, with proper entrance gates, accentuate the tone of substantial neatness and of disciplinary order maintained.

The storage holder capacity at first sight seems unaccountably small. Certainly the single, big, telescopic modern structure that looms up out of its steel containing tank has not more than a quarter or a third the generating capacity of the plant. But it is to be remembered that the plant was built by the interests owning the already existing Mutual Gas Company of Chicago in the same district, the holders and mains of which could be used by the Universal Company if necessary, to say nothing of the existing "old company's" holders and mains into which the wheel of fate, or, in other words, the result of opposing interests getting together, might yet cause gas from the Universal plant to enter. As a matter of fact, this latter is precisely what has since occurred. The four principal Chicago companies forming the old so-called Trust, have consolidated into the single Peoples Company, and this latter has acquired by purchase, and now controls, the Universal Gas Company's plant above, and the Mutual Company referred to. They thus practically control the entire gas business in Chicago, excepting the small but vigorous Ogden Company on the "North Side," and the Calumet Company, that confines its business to the small extreme southern district, 14 miles from the City Hall, known as South Chicago.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Messrs. Kirkham, Hulett & Chandler, Limited, of London, England, forwarded the following letter, which was inclosed to us by Messrs. Bartlett, Hayward & Co., under date of the 4th inst.: "Kirkham, Hulett & Chandler, Limited, beg to give notice that Messrs. Bartlett, Hayward & Co., of Baltimore, Md., have undertaken the manufacture and sale of their patent standard washer-scrubber in the United States of America and Dominion of Canada. All inquiries should in future be addressed to that firm. They will manufacture the patent standard washer-scrubber according to the latest patents in use in Great Britain and the Continent of Europe."

At the annual meeting of the Middletown (N. Y.) Gas and Electric Light Company the officers chosen were: Directors, L. C. Purdy, Theo. L. Reeve, Archibald Taylor, Philip N. Jackson, Chas. L. Mead, Jesse W. Canfield and Garret T. Townsend; President, L. C. Purdy; Vice-President, P. N. Jackson; Secretary, T. L. Reeve; Treasurer, G. T. Townsend; Superintendent, W. J. Max. The reduced schedule of rates, prior notification of the adoption of which has been given in the Journal, took effect a fortnight ago.

The recently incorporated Middletown (O.) Gas and Electric Light Company, which was organized to take over the franchises and properties of the Middletown Gas Company and of the Brush Electric Light Company, of Middletown, has named the following executive management: Directors, J. J. Gallaher, John Auer, G. N. Clapp, W. L. Dechant, C. E. Denny, T. E. Reed and W. O. Barnitz; President, W. L. Dechant; Vice-President, C. E. Denny; Secretary, Treasurer and General Manager, G. N. Clapp. The Company is capitalized in $50,000, and under its revised articles of incorporation it may engage in the supply of natural gas for fuel and lighting purposes.

Owing to the further development of the oil fields of Texas, the San Antonio Gas Company has decided to add to its works a water gas auxiliary plant, of a daily capacity of about 250,000 cubic feet. The type of apparatus is that of the standard double superheater Lowe, as constructed by the United Gas Improvement Company.

The American Pipe Cutter Company, which manufactures Anderson's pipe cutter and pipe vise, has removed its headquarters from 293 Lincoln street, Marlboro, Mass., to 163 Liverpool street, East Boston, Mass.

Mr. Alexander Badlam, who was well-known to those identified with the gas interests of the Pacific Coast, died at his home, 1024 Franklin street, San Francisco, on the night of January 25. Deceased was born in Cleveland, Ohio, in 1835, and removed with his parents to Sacramento, Cal., in 1851. In 1864 he was elected to the California Legislature, and subsequently served the city of San Francisco in various public capacities—he removed to San Francisco in 1868. A daughter and two sons survive him.

The franchise and properties of the Connersville (Ind.) Gas and Electric Company were recently sold by the receiver at public auction. The purchasers were Messrs. John A. Sly, George Griffin and Geo. K. Egbert, of New York, who represented the bondholders. Their bid was $8,000.

The Brockton (Mass.) Gas Company has moved into new and handsome office quarters, at 24 East Elm street.

Mr. George Curtis, who was one of the original promoters of the Roxbury (Mass.) Gas Company, died at his home, No. 74 Highland street, Roxbury, the morning of the 6th inst. Deceased was born in Westminster, Mass., September 31, 1817, and settled in Roxbury in 1837, where he engaged in the building trade, and subsequently went into the lumber business on a large scale, retiring therefrom after amassing a fortune, in 1885. He is survived by two sons and two daughters. One of his sons was Mayor of Boston.

At the annual meeting of the Salinas Light and Water Company, of Salinas City, Cal., the officers chosen were: Directors, J. B. Iverson, Wm. Vanderhurst, C. W. Quilty, J. H. McDougall and E. Archer; President, J. B. Iverson; Vice-President, E. Archer; Treasurer, Wm. Vanderhurst; Secretary, J. H. McDougall, vice Mr. H. J. Wilke, resigned.

"Observer" forwards the following: "Sequential to the statement of about a month ago, that the New England Gas and Coke Company had secured the Brookline, Jamaica Plain and Dorchester Companies, and the control of the balance of the field, and as confirming it came the announcement, in several of the Boston papers, that the fee of $500,000 had been paid to the gentlemen through whose generalship the deal had been accomplished. It was assumed that 10 per cent. of the profits would be a fair rate of payment, from which standpoint it is figured that a cash increment of $5,000,000 accrued to the parties in interest. This seemed to satisfy the Lawson faction that previous rumors were correct, and their threats, made shortly before, were at once redeemed by their bringing suit against the Boston Companies; the Bay States, of Massachusetts, New Jersey and Delaware; the New England Gas and Coke Company, and the parties in interest individually. The bill asked the cancellation of the trust agreement made in October, 1896 (whereby the control of the management of the Boston Companies was placed in the hands of trustees; the discharge of the trustees, and the return of the stock of the Bay State, of New Jersey, to its owner, the Bay State, of Delaware), which would break up all agreements and contracts.) Several hearings in the suit were held at which the

legal representatives of the parties appeared, the hearings being adjourned by agreement several times till now, when they are put over to the early spring. Meanwhile no reasonable doubt can exist that pronounced efforts were made to effect an agreement. Meetings of the representatives of the factions are reported to have been held, statements of the settlements of the suits appeared one day, only to be contradicted the next. In fact, some of these statements went so far into detail as to name the terms of agreement and to specify boards of directors and other inside matters, thus causing the thought that all was based on other than mere rumor. The agreement seems to be put off, for a while at least, by the unwillingness of the Lawson faction to moderate its original demands. In fact, Mr. Lawson states his position, in his usual brilliant and warm metaphor, by remarking that, while in particular Hades is reported to be paved with good intentions, companies in general are equally suitable material for macadamizing purposes, he does not propose to compromise. The Massachusetts Pipe Line Company appears also to have gotten into trouble, in having issued stock prior to taking the necessary steps before the Board of Gas and Electric Light Commissioners. The failure having been brought to the attention of the Company, it has petitioned the Board for the latter's approval of the $1,000,000 of stock *already* issued. As Mr. Lawson's first step had failed to checkmate, as a second move he petitioned the Board for a hearing on the petition for approval of this stock, which hearing was set for the 10th inst. Mr. Lawson claims that the New England Gas and Coke Company has no right to do business under the laws of Massachusetts, the Massachusetts Pipe Line being the only one recognized by the laws of the State, and that as this Company is illegally organized and has illegally issued stock it should be forbidden to do business. Following this, one day later, comes a bill introduced into the Legislature to extend the provisions and restrictions of the present laws relating to such organizations as the New England Gas and Coke Company; and this is evidently instigated by the Lawson faction as its third line of attack. If from all this discreditable performance, the general public can see itself to blame in having allowed the charter of the Whitney Pipe Line bill of two years ago, some good may yet come of it; but we imagine this is too much to expect.——On Monday, January 31, the closing day for the introduction of new measures in the Massachusetts Legislature, a great many bills affecting the gas business were introduced. A hasty reading of the incomplete details afforded by the newspapers gives one the opinion that if all are passed with the possible amendments, the gas business of Massachusetts will suffer from a bigger blizzard than that provided by the elements the same day.——The blizzard of Monday night (Jan. 31) destroyed all electric lighting service in and around Boston for many miles during the late night of Monday, and on Tuesday night, Boston, and all the surrounding cities and towns for many miles were absolutely without electric lights; and it will be several days before the complete renewal of the service will be possible. There are no reports that the gas service in any of these towns was in any way affected, which only goes to show that gas had nothing to fear and can always be depended upon for reliability. Even that portion of Boston supplied by underground wires had to be cut out on account of contact of other wires with such portions of the system as branched from the conduits to the consumers and to lamp posts."

AT the annual meeting of the Leominster (Mass.) Gas Light Company a semi-annual dividend of 2 per cent. was declared, and the following officers were elected: Directors, Nahum Harwood, Howard M. Lane, George F. Morse, George A. Lane and Chas. A. Joslin; President, Nahum Harwood; Treasurer and Clerk, Howard M. Lane.

THE Messrs. Freese, of Albion, Mich., have been successful in their application for a franchise governing the operation of a gas works in Bloomington, Ind. The ordinance provides that the maximum selling rate shall not exceed $1.80 per 1,000 cubic feet, and that the works shall be in operation on or before July 1, 1898. Bloomington is the capital of Monroe County, Ind., and is located on the Louisville, New Albany & Chicago Railroad, at a point 97 miles north, northwest of New Albany, and 60 miles south, southwest of Indianapolis. It sustains, or is sustained by, several works producing different outputs in the line of iron, wood and stone products. The Indiana University is situated in Bloomington. It has a population of not less than 5,500, and is quite a likely place for an investment of the nature proposed by the Messrs. Freese.

IN connection with the "peculiarities" of some of the cases instituted for the bringing of actions against the management of the Bay State Gas Company, of Delaware, the following advertisement, which was printed in a reputable daily newspaper of Boston, is republished—for pure "disinterestedness" it is simply disgusting:

"*To the Stockholders of the Bay State Gas Company, of Delaware.*—You are invited to join a syndicate which has been formed for the purpose of bringing suit against the officers and management of the Bay State Gas Company. The business of the syndicate will be conducted by well known lawyers of Boston, Philadelphia and Wilmington, who have had long experience in Bay State gas matters, and who have never failed in former suits in compelling the Company and officers to settle with great profit to all who were associated with them. In the recent income bondholders' suit dividends as high as 500 per cent. on the face value of the bonds were declared to some of those who were joined in the suit. It will not be necessary for parties joining in this litigation to actually own stock. Any parties in a position to borrow stock to qualify them in making affidavits are eligible. The only immediate requisite is to authorize us to act. Profits will be divided: 30 per cent. for members of syndicate; 40 per cent. for attorneys; 30 per cent. for expenses. All applications must be in writing and made to the undersigned on or before Wednesday, Feb. 2.—GAS ATTORNEYS, P. O. Box 3,302, Boston."

ON the 3d inst. the Massachusetts Board of Gas and Electric Light Commissioners heard argument in the matter of the petition of the new proprietors of the Dedham and Hyde Park Gas and Electric Company for the right to increase their capital stock in the sum of $60,000, the increase to be applied to the reconstruction of the Company's manufacturing plant and in the extension of its distributing system. Capt. W. H. White and Messrs. H. A. Odell and W. Eliot Fette appeared for the petitioners. As there was no opposition, and as the arguments advanced by the proponents were well based, it is fair to assume that the increase will be allowed.

MR. HENRY BAILEY has been appointed assistant city gas inspector for Kansas City, Mo.

THE district court of Washington, Iowa, has declared that the gas plant of the Washington (Iowa) Gas and Electric Company is a nuisance, in that it is located in a section that is now much better settled than it was when the Company constructed its works. The residents have their remedy in law, which a court of higher resort will beyond doubt point out later on. They may either move or purchase the Company's property.

THE Indiana (Pa.) Gas Company has elected the following officers: Directors. Geo. R. Stewart, J. M. Schoonmaker, Thomas Sutton, A. W. Wilson, Jr., John F. Clements, H. W. Wilson and J. W. Clements; President, H. W. Wilson; Treasurer, Joseph W. Clements. The Board at the meeting voted to subscribe $500 towards inducing the Northwood Glass Company to retain its plant in Indiana.

THE action brought by Peter Losowski, in the second session of the Superior Court, Boston, Mass., against the Boston Gas Light Company, which case was tried before Judge Sherman and a jury, resulted in a verdict for the plaintiff. His award was $1; he sued for $20,000. The action was brought to recover damages for personal injuries to plaintiff consequent upon the inhalation of gas that escaped from a burner on the chandelier suspended in his room in the house, 34 Essex street, Boston, on the night of April 17, 1894. He asserted that just prior to his retiring for the night, he turned the gas off to a low point. Later on the Company's employees, while repairing some damage to the pipes in another part of the premises, shut off the gas and eventually turned it on again. The defence was a general denial.

AT the annual meeting of the Syracuse (N. Y.) Gas Company the officers elected were: Directors, R. C. Pruyn, A. C. Humphreys, Henry Seligman, Emerson McMillin, S. Peabody, W. L. Elkins, Jr., John Dunfee, C. M. Warner, W. S. Andrews, Thomas Ryan, W. B. Kirk, H. S. White and F. W. Barker; President, A. C. Humphreys; Vice-President, H. S. White; Treasurer, Stephen Peabody; Secretary, F. W. Barker.

CERTAIN prominent residents of Steelton, Pa., propose to organize a Company for the manufacture of gas for illuminating purposes.

THE handsome new office headquarters (at No. 240 Main street, Worcester, Mass.) of the Worcester Gas Light Company were opened for business on the morning of the 1st inst. The offices are lacking in nothing that goes to make an up-to-date Company headquarters.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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ELBERT P. CALLENDER,
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MONDAY, FEBRUARY 14, 1898.

Government Pipe Manufacture in Australia.

The Australasian *Ironmonger* has this to say respecting the results obtained in the manufacturing of cast iron pipe on the part of the Government of one of the Australian colonies:

The South Australian Government has been engaged for some years on the manufacture of cast iron pipes at Glanville. The Commissioners of Audit publish annually a statement of the cost, and have done this in their 15th report, just issued. Being expert accountants, but not practical pipe makers, their figures are a bit perplexing.

To begin with, we are not told what were the sizes of the pipes manufactured each month, though we learn that 2-inch, 3 inch and 8-inch account for over 2,065 tons out of a total of 2,563 tons.

The total average cost for 1896 works out at $30.95 per ton, but this is without allowance for interest on capital, cartage, wear and tear of plant, which ought to be included in estimating true cost. The lowest tender ever accepted in Victoria was for $29.25 per ton, for the Metropolitan Board of Works, but that was earlier, when raw material was lower, and it is very unlikely that they could be obtained at that figure now.

The cost of pig iron and scrap is averaged at $15.56; it would be about $17.50 in Victoria. Wages, with shop charges (30 per cent. on wages), amount to $11.57 per ton, which seems very high.

The value of flux varies surprisingly, from $8.89 for one lot of 100 tons to $124.29 for another lot of 310 tons; and, still more extraordinary, the first lot showed a loss of 16 tons in weight of molten metal, and the second a gain of over 14 tons. These figures are very hard to reconcile without absolute details.

The cost of coke is put down at $6.06 per ton, working out, with flux, etc., at $1.77 per ton of molten iron. But the quality or kind used is not mentioned. Experience, verified in many instances in Victoria shows that the best results have been obtained from the use of Scotch pig and scrap, with standard Brancepeth or equal coke, which, with flux, etc., ranged from $1.87 to $2.08 per ton of molten metal. Trials with gas coke worked out as low as $1.66 per ton for coke, but the increased time and labor in handling more than counterbalanced the saving.

Shop charges are fixed at a uniform 30 per cent. alike for pipes and for other castings. As the cost of labor is necessarily higher on the latter, the are made to bear more than their share of shop charges.

The figures, therefore, need supplementing before they can tell a clear story. But they show that the Government is making no great bargain. The report mentions that 1897 is expected to show a still higher average cost, so that when all the omitted items are included there cannot be any saving worth mentioning.

The Market for Gas Securities.

The local gas share market is unsteady and erratic, with marked firmness in Mutual and a generally lower scale in the other city stocks. Consolidated sold as low as 187, on advices from Albany that the legislature might pass a dollar gas bill, but we believe it doesn't matter much whether such a measure goes through or not. To-day (Friday) Consolidated opened at 189 to 189¼, and at noon sales were made at 189¼. We have no hesitation in saying that it is cheap at the figures reported.

There was quite some demand for Mutual, but even at the sharp advance in the bid rate little if any stock changed hands. The quotations are 330 to 340, and holders are talking confidently of 400 for it in the near future. Up to to-day we have heard of no withdrawals of stock from the proposed merger of the Equitable, East River, New Amsterdam Companies, so it may be taken for granted that the deal will go through. New York and East River common is 79 to 81½; Standard common is 145 to 148, the preferred being quoted at 160 to 167; and Equitable is 225 to 232.

Brooklyn Union, evidently on sales for profit taking, sold down something from recent high prices, but the demand for it is steady and persistent. To-day it is 121½ to 123¼. The bonds of the Company are 114¼ to 114½. Bay State is about as it has been for a fortnight, although there is a marked lull just now in the avalanche of legal proceedings connected with the "readjustment" of Boston's gas properties. Our "Item columns" contain an advertisement reprinted from a Boston daily, which goes to show how easily suits may be brought by non-owners of shares in a corporation. The advertisement and its implications are nothing short of scandalous.

Lacledes, both common and preferred, show slight advances over the reported prices of a week ago, and Detroit gas moved up sharply to 59½ bid. The Indiana group shows fair strength, and Baltimore Consolidated is off again, on renewed legislative attacks. Peoples, of Chicago, is sought after at 98¼ to 98⅝; the quarterly dividend on it of 1½ per cent. is payable on the 25th inst.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

FEBRUARY 14.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	190	191
Central	500,000	50		..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	225	232
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	330	340
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	..	.
" Bonds	150,000	1,000	..	.
New York and East River	5,000,000	100	79	81½
Preferred	2,000,000	100	112	115
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106½
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	145	148
Preferred	5,000,000	100	160	167
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	180	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	121½	123½
" " Bonds (5's)	15 000,000	1,000	114¼	114½
Bay State	50,000,000	50	3⅞	4
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	..	90½
2d " " "	3,000,000	1,000	72	75
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	80	91
1st Mortgage	1,085,000	..	101	103½
Consumers. Jersey City	2,000,000	100	77	..
" Bonds	600,000	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	206¼	207
Consumers, Toronto	1,800,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	.
Consolidated, Baltimore	11,000,000	100	54¾	55¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		59½	60
" Con. Bonds	4,312,000	..	98¼	99
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	81	85
" Bonds	2,000,000	..	87	90
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	118	125
" Bonds, 6's	2 650,000	..	106	107
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	86	88
Bonds	1,000,000	1,000	89	92
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	43½	44
Preferred	2,500,000	100	91	93
Bonds	9,034,000	1,000	104	104½
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Oakland, Cal.	2,000,000	..	53¼	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	98¼	98⅜
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	20	22
Bonds	1,000 000		94	97
Washington, D. C	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	83	84
Bonds, 5's	3,556,000	.	103	104
Wilmington, Del.	550,000	50	200	

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FACTS

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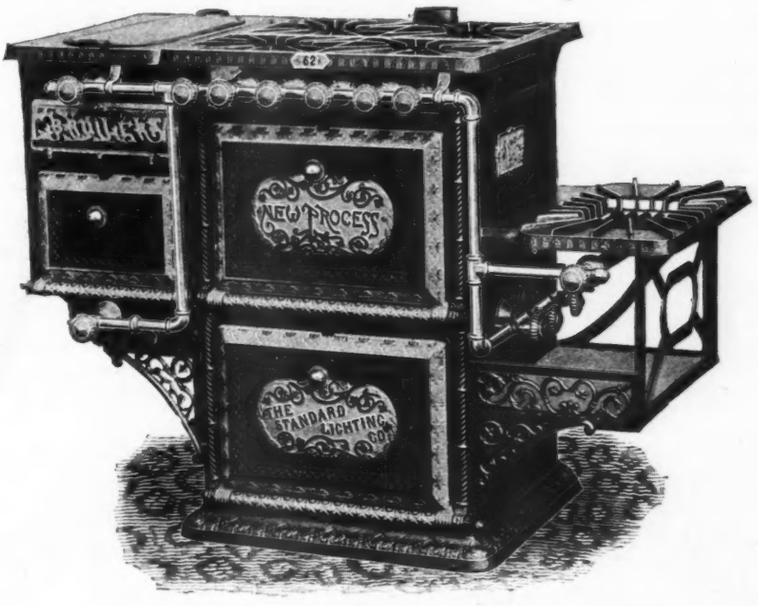

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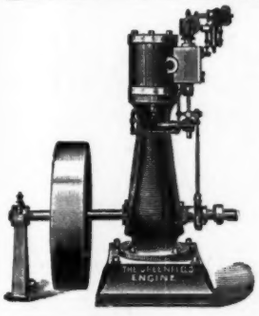

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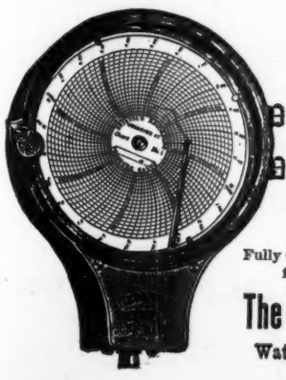

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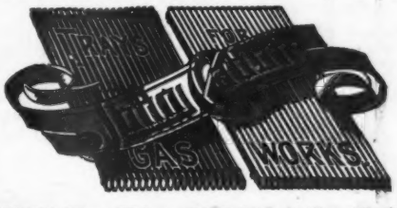

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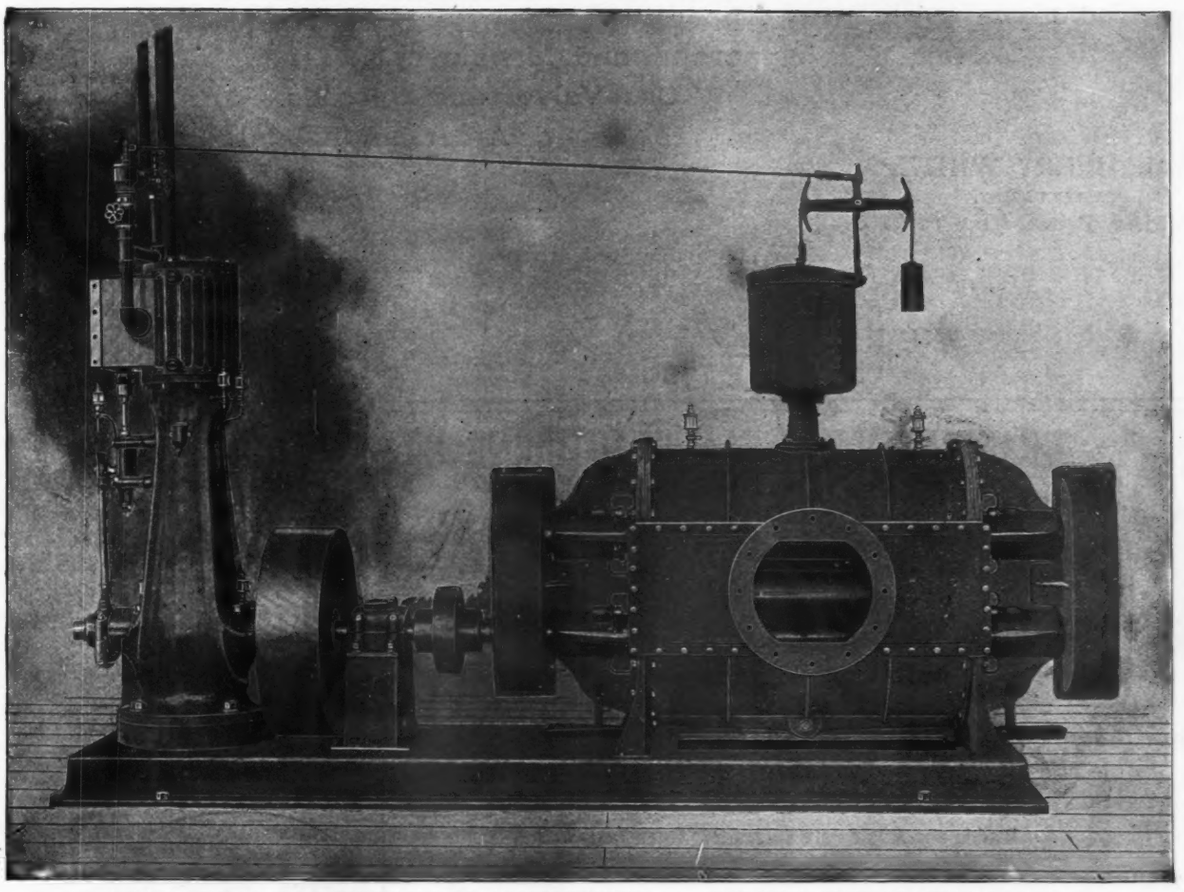

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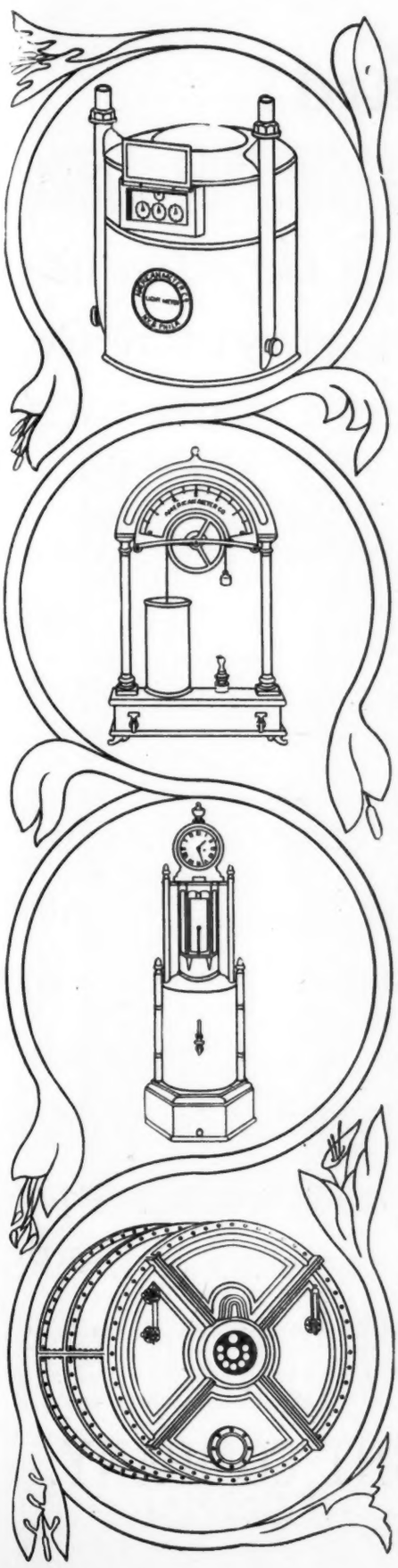

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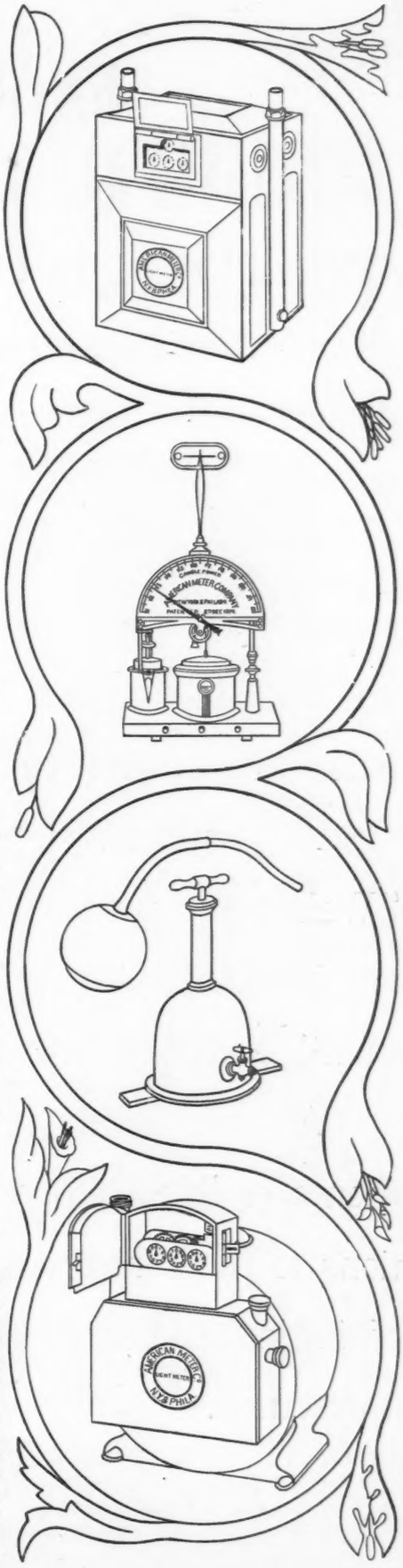


PUBLIC LIGHTING TABLE.

FEBRUARY, 1898.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	3.20 AM	6.10 AM	5.05	6.15
Wed.	2	4.10	6.10	5.05	6.15
Thu.	3	4.50	6.10	5.05	6.15
Fri.	4	5.20	6.10	5.05	6.15
Sat.	5	No L.	No L.	5.10	6 10
Sun.	6	No L. PM	No L.	5.10	6.10
Mon.	7	No L.	No L.	5.10	6.10
Tue.	8	6.00 PM	8.40 PM	5.10	6.10
Wed.	9	6.00	9.50	5.10	6.10
Thu.	10	6.00	11.00	5.10	6.10
Fri.	11	6.00	12.10 AM	5.10	6.10
Sat.	12	6.00	1.20	5.20	5.55
Sun.	13	6.10 LQ	2.30	5.20	5.55
Mon.	14	6.10	3.40	5.20	5.55
Tue.	15	6.10	4.40	5.20	5.55
Wed.	16	6.10	5.40	5.20	5.55
Thu.	17	6.10	5.50	5.20	5.55
Fri.	18	6.10	5.50	5.20	5.55
Sat.	19	6.10	5.50	5.30	5.55
Sun.	20	6.20 NM	5.40	5.30	5.55
Mon.	21	6.20	5.40	5.30	5.55
Tue.	22	6.20	5.40	5.30	5.55
Wed.	23	6.20	5.40	5.30	5.55
Thu.	24	6.20	5.40	5.30	5.55
Fri.	25	10.20	5.40	5.30	5.55
Sat.	26	11.20	5.40	5.30	5.45
Sun.	27	12.20 AM FQ	5.30	5.30	5.45
Mon.	28	1.10	5.30	5.30	5.45

TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45

$500.00 Reward!

THE PUBLIC IS CAUTIONED that imitation and worthless incandescent burners and mantles are being sold by unscrupulous dealers on the representation that they are the genuine "Welsbach."

THE WELSBACH LIGHT COMPANY will pay $500.00 reward for the arrest and conviction of any person representing and selling incandescent burners or mantles as genuine "Welsbachs" that do not bear our trade-mark.

All genuine Welsbach lights have stamped on the brass work "Welsbach System, Patented," and all genuine Welsbach mantles are branded with our trade-mark, "J," and both burners and mantles are sold in boxes bearing our trade name, "Welsbach."

All other incandescent gas lamps and mantles are infringements of this Company's patents, notwithstanding representations to the contrary, and all manufacturers, sellers or USERS of infringing burners or mantles are liable to be and will be prosecuted.

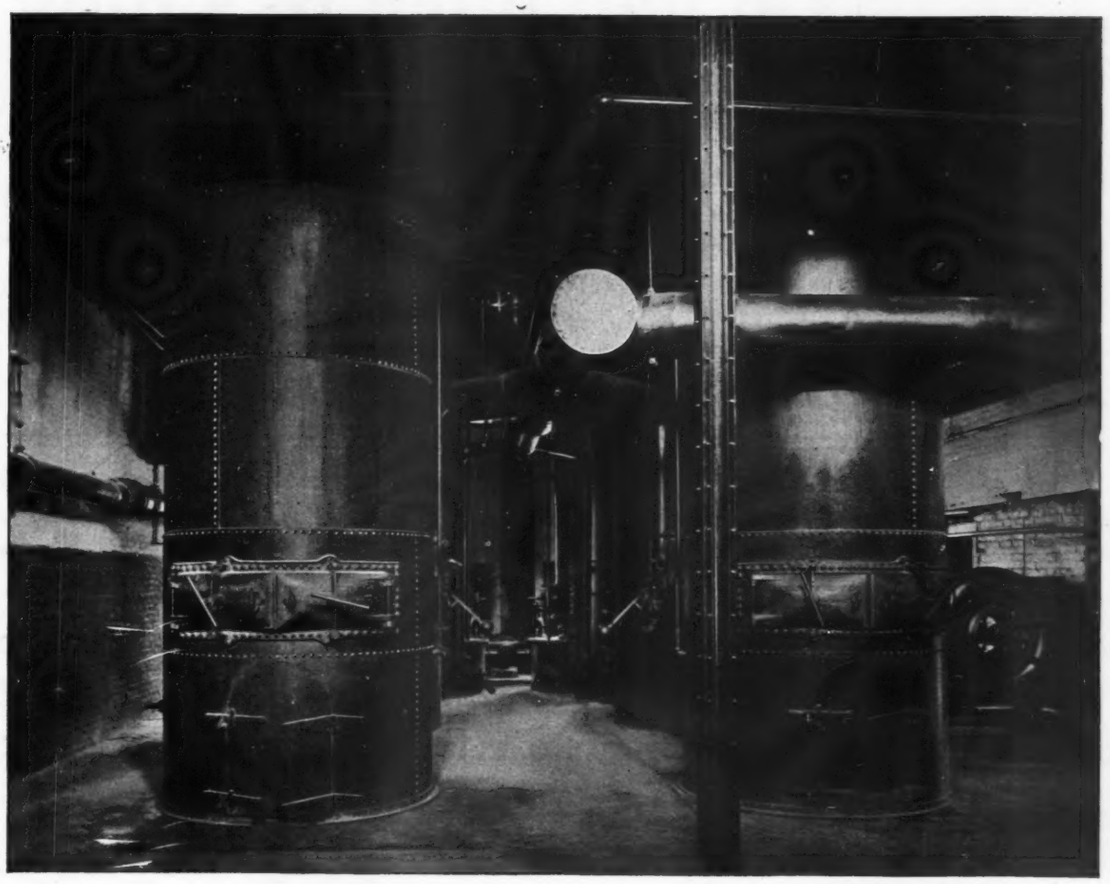
WELSBACH LIGHT COMPANY.

STANDARD

DOUBLE-SUPERHEATER LOWE WATER GAS APPARATUS.

Number of Installations to Date, - - 244

Total Daily Capacity, 131,825,000 Cu. Ft.



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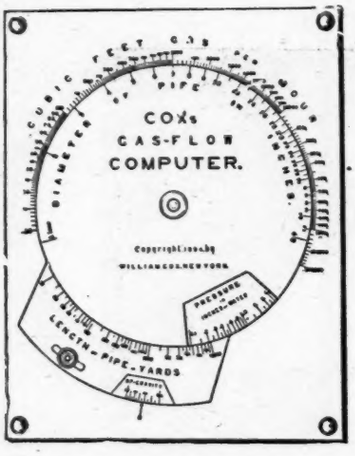

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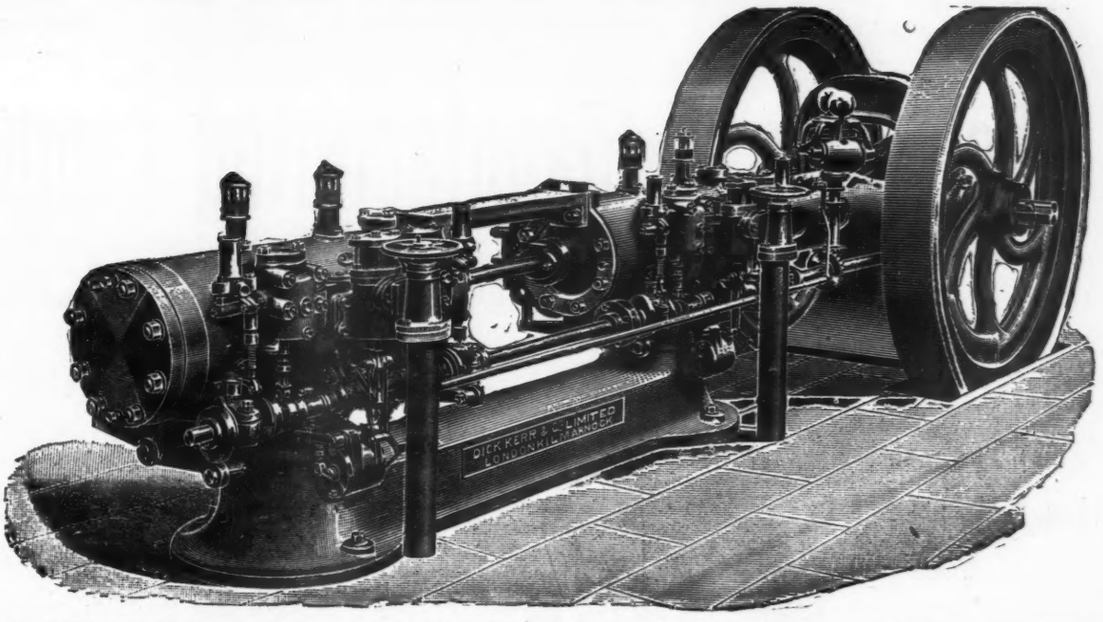

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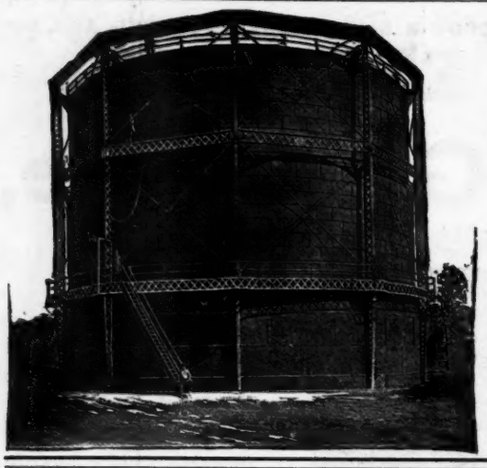

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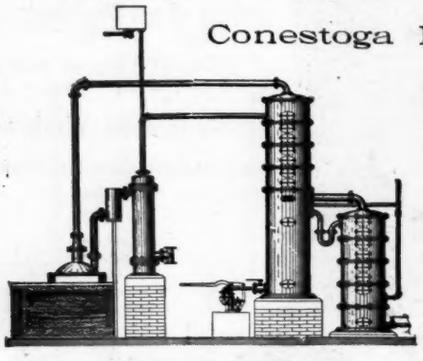

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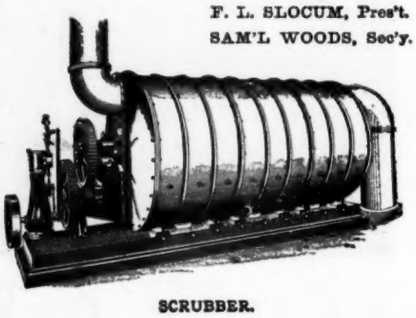

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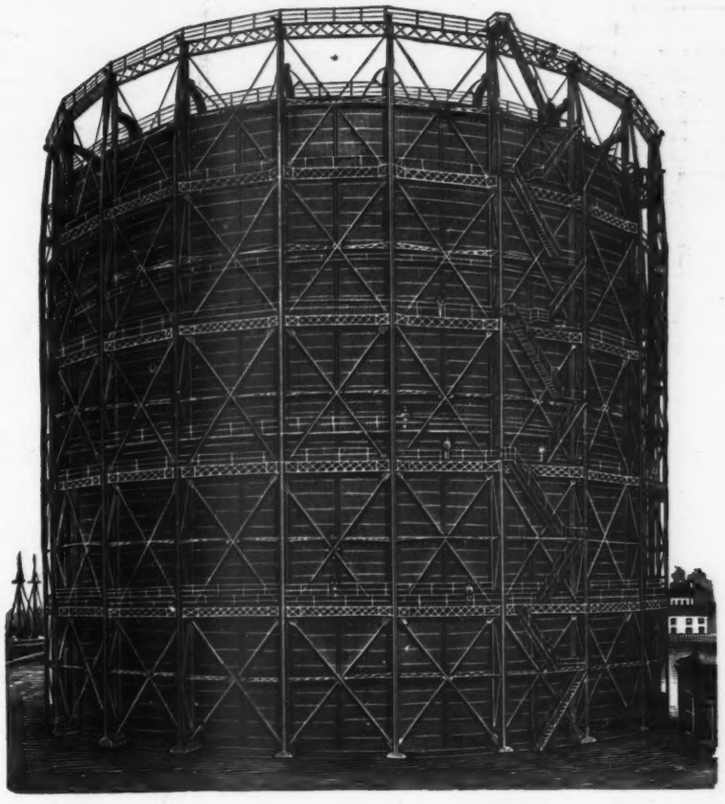

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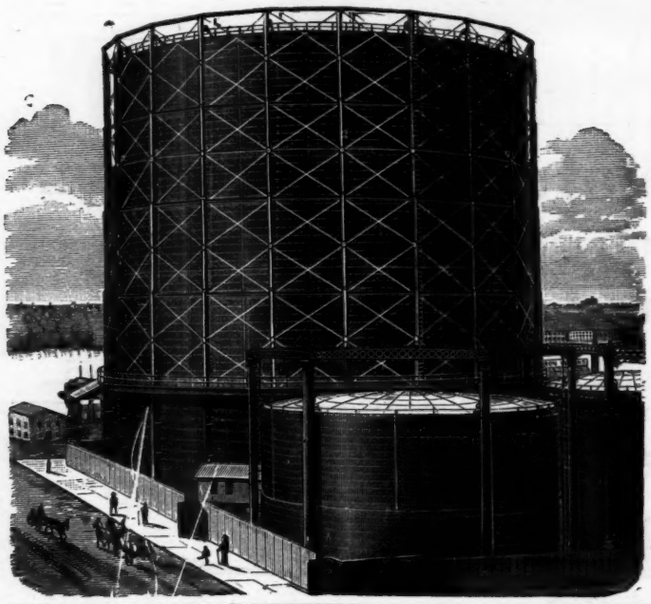

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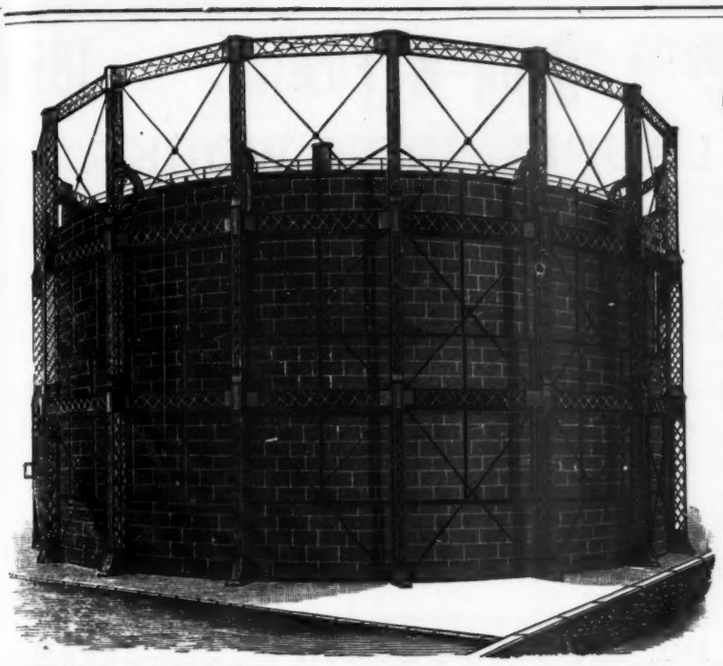

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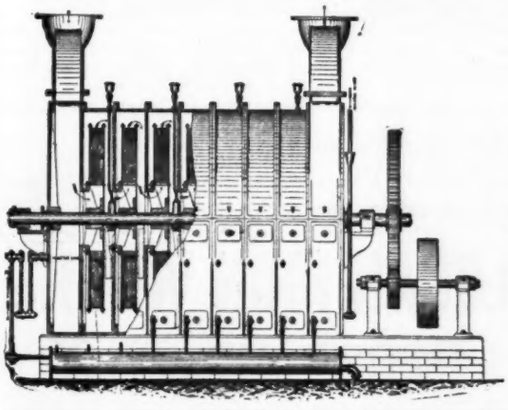

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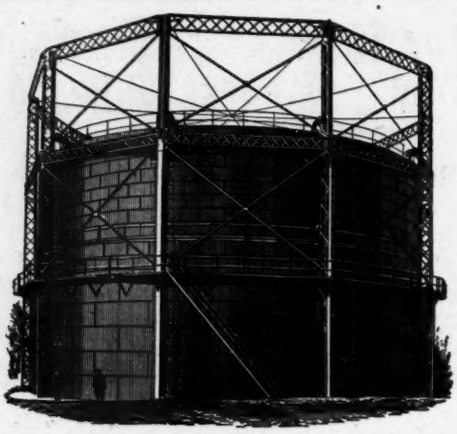

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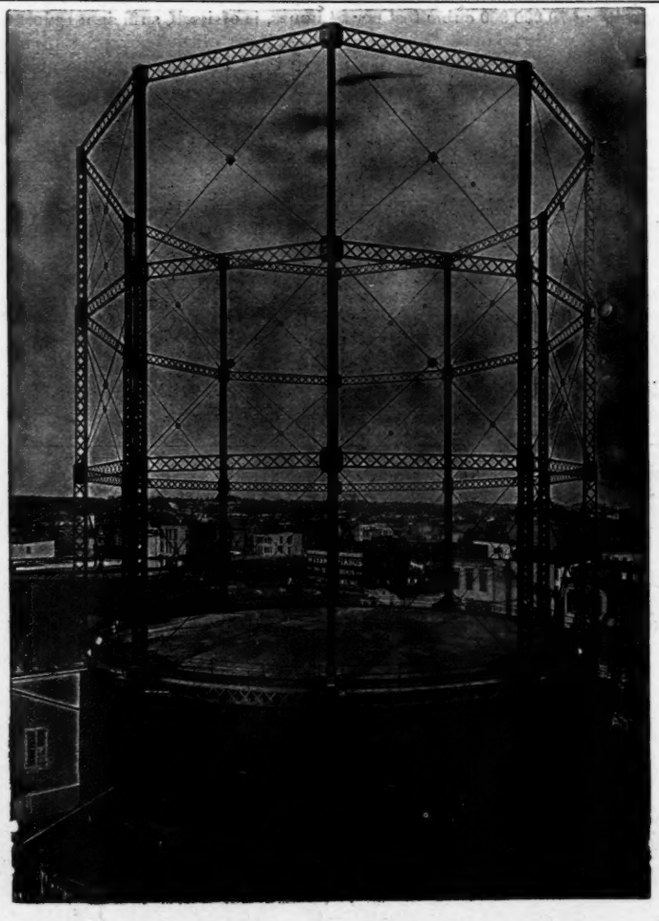

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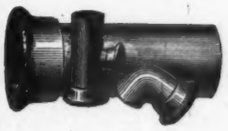

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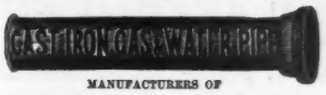

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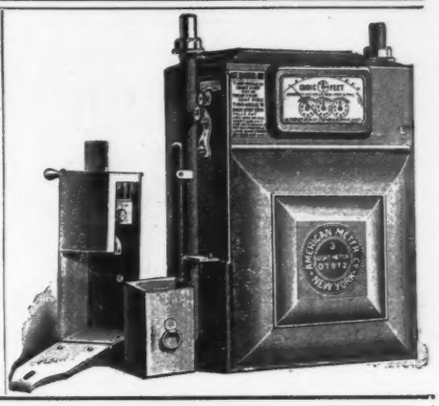

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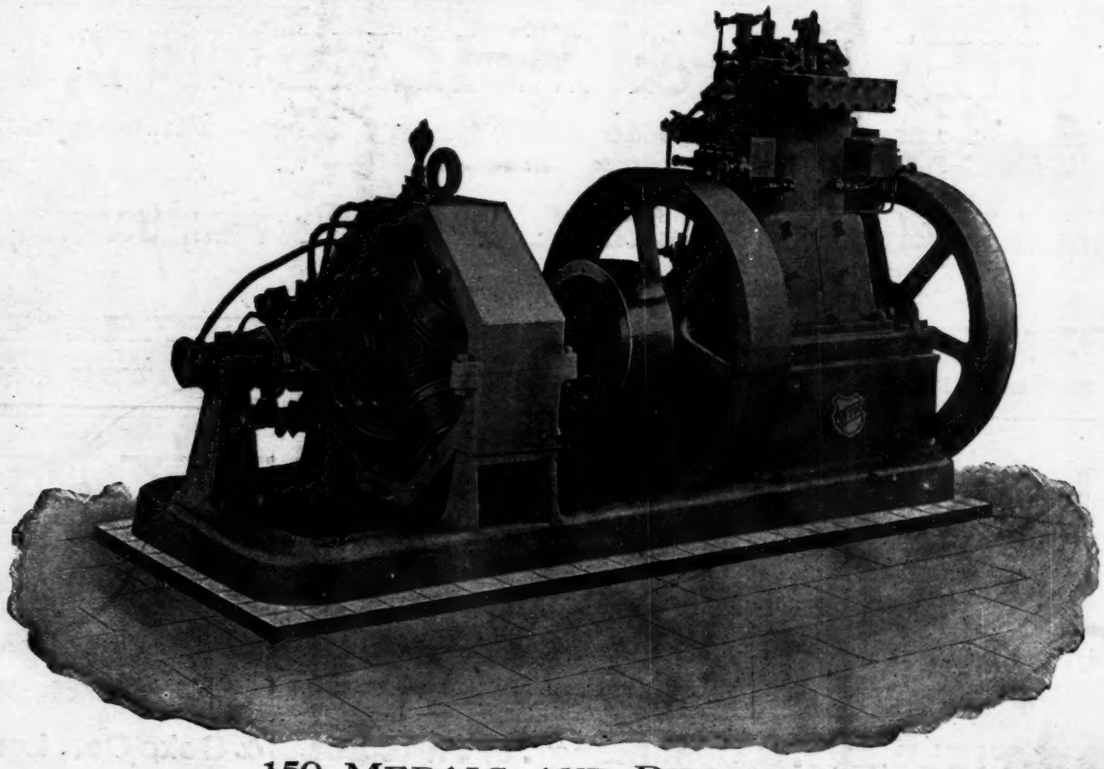

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